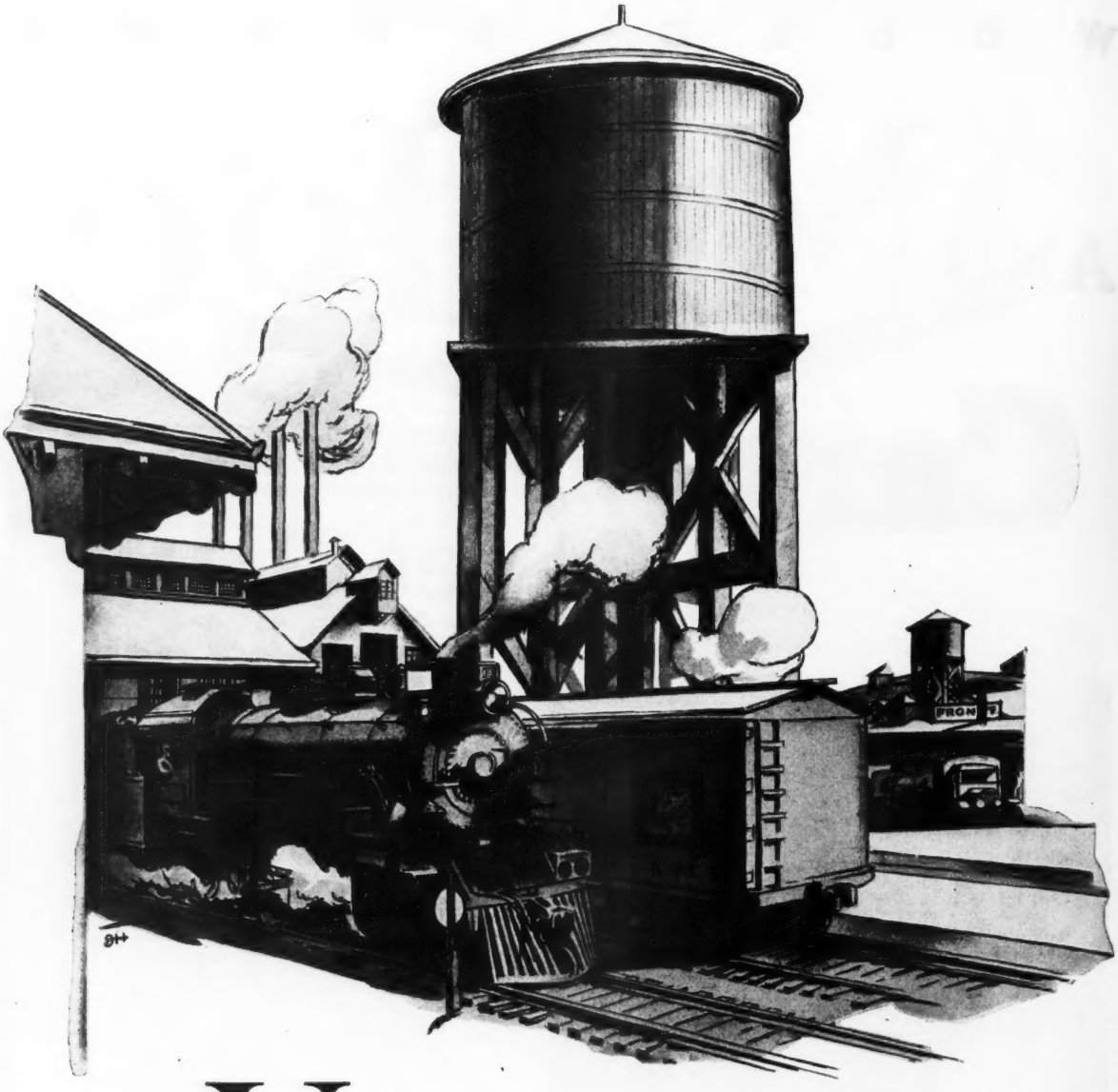
Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoce at Chicago, Illinois, under the Act of March 3, 1879

Alphabetical Index to Advertisers, Page 64
Classified Index to Advertisers, 60-62



VICTORIOUS!..

in 36,500 battles against rain and rot... heat and cold

In a century there are 36,500 days. And in hundreds of century-old Tidewater Red Cypress structures, the original wood has fought and won 36,500 battles against rain and rot ... heat and cold.

Year by year, railroads are using more Tidewater Red Cypress on structures that must fight weather. And mile by mile, they are shaving down the number of dollars needed to operate their lines. For this durable lumber doesn't know replacement.

Grown in water, Tidewater Red Cypress resists water. Fortified naturally with "cypressene," it fights off rot. No wonder, then, that railroad men find it especially adapted for passenger station construction, freight sheds, warehouses, ties, platforms, signal conduits, water tanks, box cars, fencing, and for wherever else its long life can insure freedom from repairs.

Technical data will be supplied gladly by the Southern Cypress Manufacturers' Association of Jacksonville, Florida.

TIDEWATER RED CYPRESS

F_{1c} = Force acting on unit volume of iron.
F^1_c = Force acting on same volume of gas.
F_c = Force tending to remove gas from iron.

In the manufacture of deLavaud Pipe, a force 40 times greater than gravity drives out impurities and builds a 25% stronger pipe.

deLavaud Pipe is made by pouring molten iron into a rapidly revolving cylindrical mold. Centrifugal force holds the metal against the sides of the mould and drives out impurities with a force, which every engineer knows, is 40 times greater than gravity.

Thus deLavaud Pipe is remarkably free from slag and weakening gas bubbles. And because it is actually cast under the pressure, resulting from the force $F_c = \frac{Wv'}{gR}$ the pipe wall is dense and strong, allowing a greatly increased carrying capacity.

The results of strength tests performed on deLavaud Pipe are little short of amazing. In tests recently conducted by an outside authority, deLavaud results (when compared with good pit cast pipe) showed 100% greater tensile strength, 65% greater transverse strength and 25% greater bursting strength.

Cast iron pipe made by this Company bears the "Q-check" trademark of The Cast Iron Pipe Research Association.

Engineers and contractors who want a gas or water pressure pipe of greater durability and a greater factor of safety will find it a satisfaction and a surprising economy to specify deLavaud Pipe.

Let us send you the deLavaud handbook. Here you will find all the facts and figures about deLavaud Pipe, including types of joints and dimension tables.

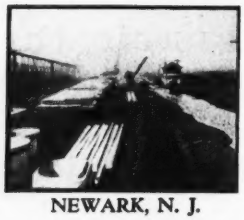
United States Pipe and Foundry Co., Burlington, New Jersey

Sales Offices: New York, Philadelphia, Pittsburgh, Cleveland, Buffalo, Chicago, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, San Francisco, Los Angeles

Concrete Culverts

The MASSEY

CLEARING (Chicago)

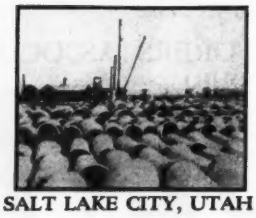


NEWARK, N. J.

MONTGOMERY, ALA.

DALLAS, TEX.

MELBOURNE, KY.
(Cincinnati)



SALT LAKE CITY, UTAH

These are two of the standard products available in all Massey plants. They have been adopted as standard by most of the leading railroads, because years of satisfactory service have demonstrated the value of Massey quality.

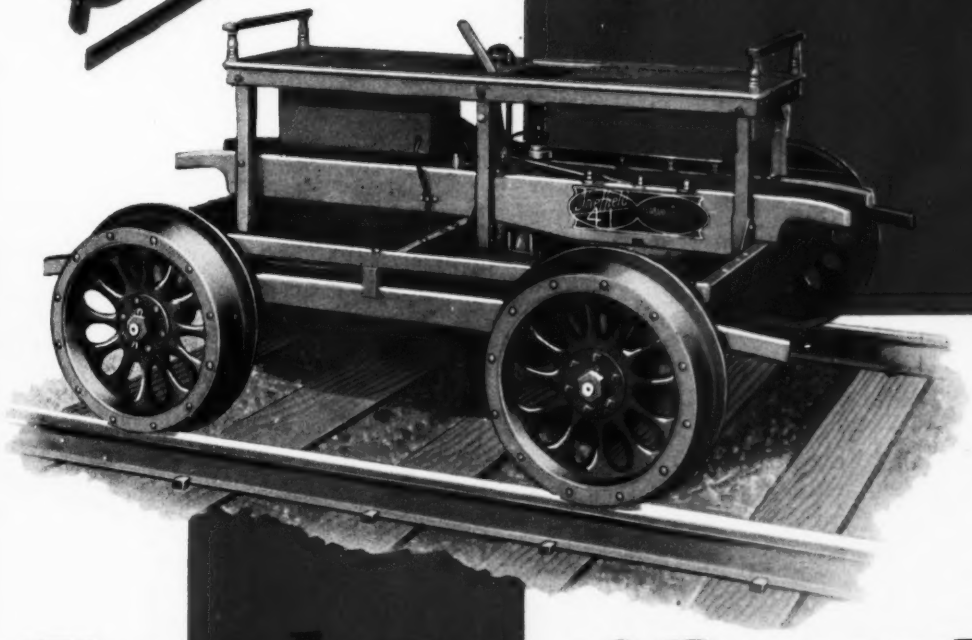
Massey Concrete

Peoples Gas

Sales Offices: New York, Atlanta, Minneapolis,

Canadian Concrete
Transportation Bldg.,

"Sheffield 41"



The *class* of the road!

A centerload car that has become one of the taken-for-granted, reliable factors of railroading! For getting roadmasters, supervisors, linemen, etc., over the road, the "Sheffield 41" has demonstrated its class for over a decade.

Years of service have justified its sound design and construction. Not a single weakness or inadaptability has made necessary so-called "improvements." When you purchase a "Sheffield 41" you buy a time-tested, known quantity of dependable service unapproached by any other car in its field.

FAIRBANKS-MORSE MOTOR CARS

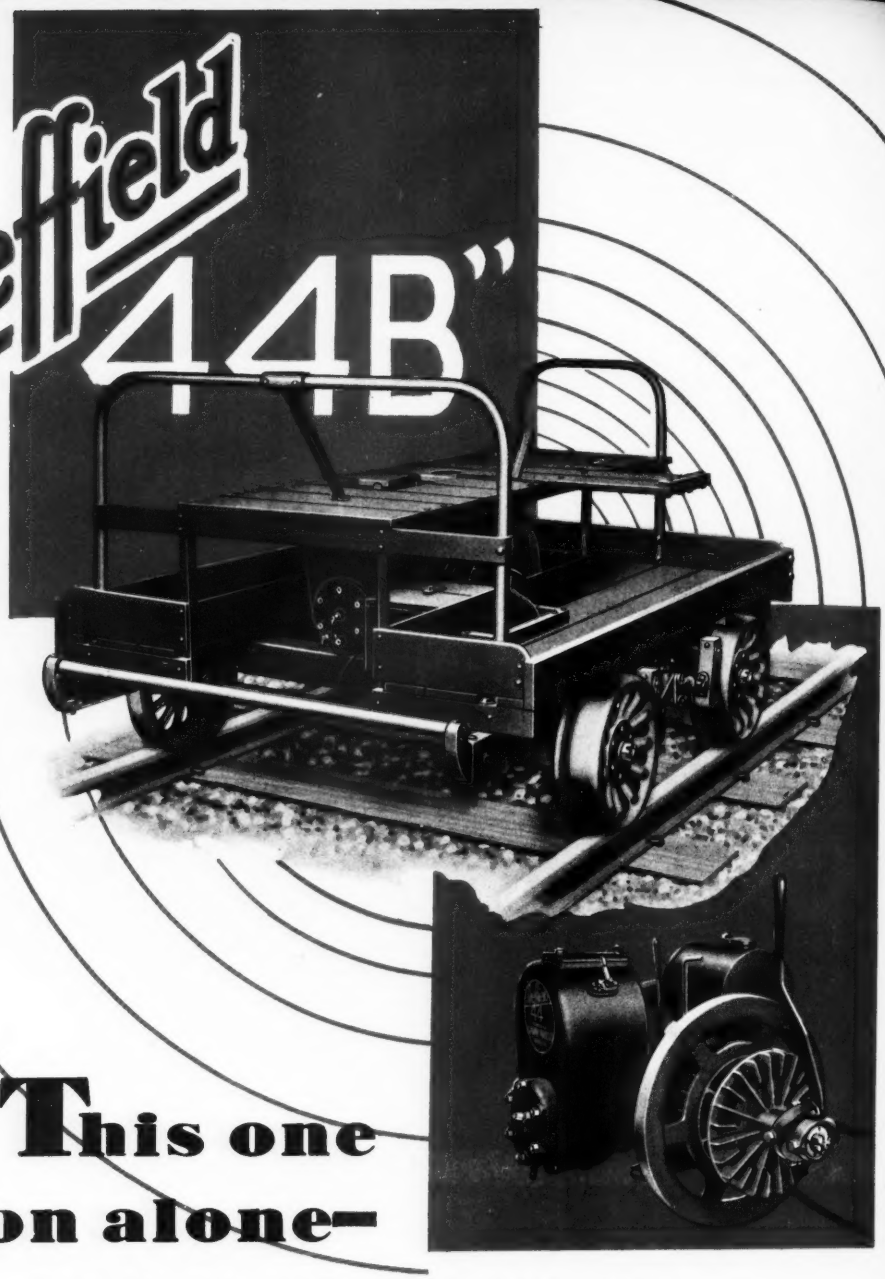
TIMKEN BEARING EQUIPPED

F M

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

"Sheffield 44B"



This one reason alone—

It's a great car—most railroad men know it is the best single-cylinder section car on the rails! It is built by a maker whose guaranty means something. Lightness is combined with strength—its huskiness makes no sacrifice to fuel and oil economy. These are all valid reasons for purchasing "Sheffield 44B's." But one reason stands above them all.

You can put this car on a section with greater assurance that it will stay out of the repair shop.

The clutch cannot be burned out:

The clutch is built to "slip" when it should slip, and rough handling cannot put it out of order. Special plates and cooling fins beat the heavy hand that "rides" a clutch.

Just send for a bulletin giving a complete description and specifications.

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

TIMKEN BEARING EQUIPPED

RA 21.65

First on the rails — and still first

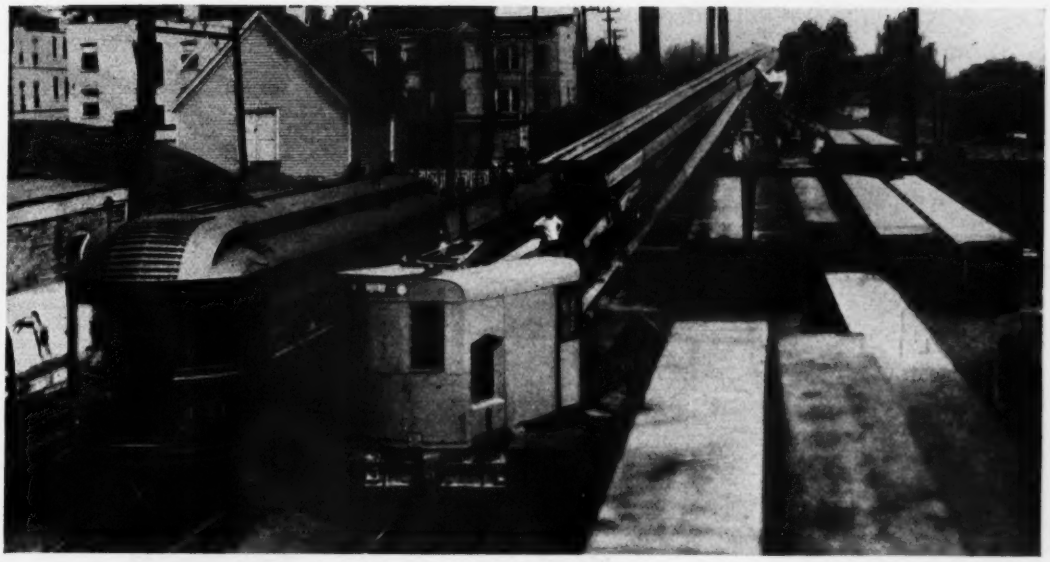
FAIRBANKS-MORSE

MOTOR CARS

Model 20

BURRO CRANE

Model 30



Burro Crane setting timbers on a trestle for track elevation. Short tail swing, only 6'-3", saved a tremendous amount of time on this job as the Burro's operation was not interfered with or stopped by trains which passed on the adjoining track every 4 minutes. Track centers 13'-0". A guard over the boom and cable prevents their touching the trolley wires.

Short Tail Swing

assures

Increased Operation

It is unnecessary to interrupt the Burro's operation due to trains passing on an adjoining track and the Burro will efficiently operate in extremely close quarters in yards.

Absolute Safety

No possibility of a side swipe by trains passing on the adjoining track.

Burro Features

Utility
Long Reach
Low Overall Height
Travel Speeds
1½ to 20 miles per hour
Draw-Bar Pull
6000 to 7000 lbs.
Rated Capacities
Model 20 . . . 11,000 lbs.
Model 30 . . . 14,700 lbs.

Write for Bulletin F-50

CULLEN-FRIESTEDT CO.
1300 So. Kilbourn Ave.
CHICAGO, ILLINOIS

Bethlehem Braced Flangeway Guards installed at a main highway crossing near Detroit.

Smoother Crossings

The web of the Bethlehem Braced Flangeway Guard is provided with rectangular openings through which the braces are inserted and locked.

Less Maintenance

WITH the Bethlehem Braced Flangeway Guard, rail movement and vibration, which otherwise would tend to break down the paved surface, are not transmitted to the paving. The guard is spiked direct to the tie; heavy braces hold it rigidly in position against the pounding of heavy, high-speed automobile, truck and bus traffic.

The Bethlehem Flangeway Guard is furnished in long sections, up to twenty feet, which are usually welded together on the job, although bolted splices are provided. Crossings equipped with this guard remain safe and smooth, with very little maintenance. Write for descriptive literature.

BETHLEHEM
BRACED
FLANGEWAY GUARD

BETHLEHEM STEEL COMPANY, General Offices: Bethlehem, Pa. *District Offices:* New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland and Honolulu.

GOOD WILL MESSENGERS

KALAMAZOOS are taken into every country where the railroads use motor cars. Here their "honor bright" construction, their unique utility, their money-saving service, create good will, not only toward their manufacturers but toward their home.

Whatever the needs of the road, there's a Kalamazoo Motor Car ready. Catalog on Request.

Kalamazoo 216-L Inspection Motor Car illustrated below—the Safety First one-man Inspection Car for Supervisors, Roadmasters, Signalmen, Linemen, Car Repairmen, Inspectors, Operators, etc. Equipped with powerful toggle lever brakes which act on four wheels. The brake shoes are cast iron, insuring positive braking power at all times.

Motor Car No. 216L

"Kalamazoo Means Service to You"

KALAMAZOO RAILWAY SUPPLY COMPANY

MANUFACTURERS—Established 1883

KALAMAZOO, MICHIGAN

CP COMPRESSORS Recently Installed By Three Large Railroads

C-283

These installations are repeat orders from three prominent railroads whose experience with CP Compressors has proved their reliability and high sustained efficiency.

The Simplate Air Valve; the piston type of steam valve; efficient regulation of both the steam and motor-driven types; sturdy construction; reliable automatic lubrication and world-wide CP service facilities are some of the reasons why CP Compressors are preferred by Railroad engineers.

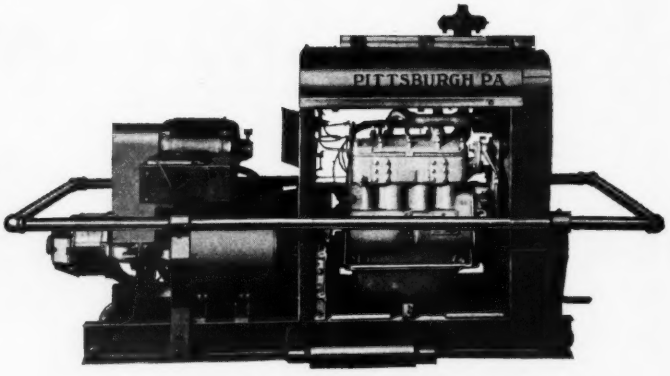
There is a CP Compressor, stationary or portable, in steam, oil, belt or direct motor driven type, for every compressed air purpose. Write for literature.

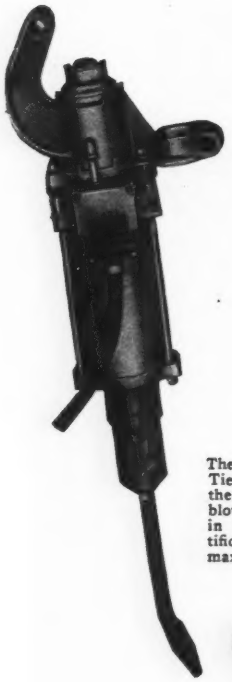
Chicago Pneumatic Tool Co.
Railroad Dept.

6 East 44th St. - - - - - - - New York
310 S. Michigan Ave. - - - - - Chicago
1004 Mutual Bldg. - - - Richmond, Va.
175 First St. - - - - - San Francisco
Terminal Tower - - - - - - Cleveland

Modern track tamping is Electrical

Compact, Efficient and Rugged, the SYNTRON Power Unit is a Veritable Dynamo of Power





The powerful SYNTRON Tie Tamper operates at the rate of 1500 speedy blows a minute, is light in weight, and scientifically balanced for maximum efficiency.

RAILROADS no longer have to depend upon cumbersome methods and machinery for track surfacing. The widespread recognition that track surface is best maintained electrically has called for wider use of electrical tie tamping equipment.

With the SYNTRON Electric Outfit, you have the most flexible unit on the market, that does not call for special engine or crane to move it, because the SYNTRON Power Unit is compact, extremely light in weight, only 20 inches wide, rests on the track shoulder and can be easily moved about by five or six men. Equipped with dolly wheels, it is quickly run along the rail.

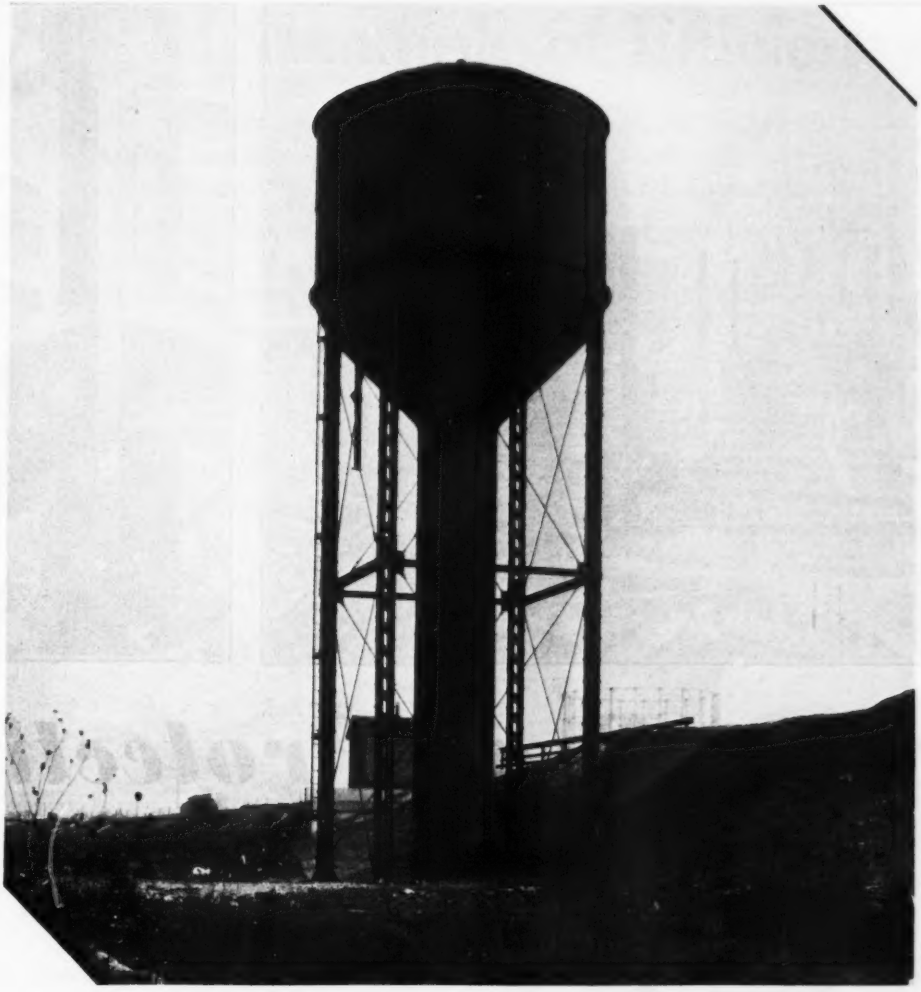
Besides operating sets of four, six or eight tampers, the SYNTRON Power Unit runs a large number of electric labor-saving devices, including arc welding outfits.

For the sake of economy and efficiency of track surfacing, be sure to write for free literature describing the new SYNTRON Outfit.

SYNTRON

Electric Tie-Tamping Outfits

SYNTRON CO., 400 LEXINGTON AVENUE, PITTSBURGH, PA.



Steel tanks built any height

You don't have to sacrifice the advantages of a steel tank just because you have a location where you cannot use a 15-foot to bottom tank. A steel roadside delivery tank can be built any height you may happen to require.

Two panel tanks are not uncommon, and even higher ones are in use. Whenever the tank site is lower than the elevation of the track, the height of the tank posts are simply increased to provide the pressure required.

Steel tanks are not only available in any height, but a wide range of capacities. The larger ones, holding 200,000 to 300,000 gallons, provide storage at an economical cost. The single structure also conserves space, an important factor in yards and congested locations.

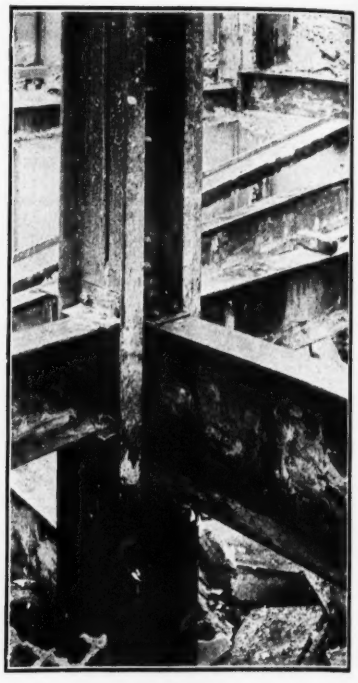
Whenever contemplating additional tanks, get our quotation. The location, capacity and height to bottom is all in the formation we need to quote you on our standard design.

CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Term. Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	1036 Healey Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.
Boston	1522 Consolidated Gas Bldg.	Havana	Apartado 2507

B-107

HORTON TANKS



Here's Real Protection

Thirty years ago this steel was painted—and it is still in perfectly sound condition. What paint?—RED-LEAD!

AGAIN, in actual use, red-lead paint demonstrates its remarkable ability to give complete protection to metal over a period of many years.

Steel work used in the construction of the Wyatt Building, Washington, D. C., was painted with red-lead, and installed in 1897-1898. In January, 1929, this building was torn down.

Red-lead kept steel sound

The unretouched photographs reproduced on this page tell a striking story. After thirty years, the steel work is in excellent condition—still protected against rust by the original film of red-lead.

You can expect extreme durability *where red-lead paint is used.* Three coats of pure red-lead give steel work a protection that is unexcelled.

High quality red-lead

Pure, fine and highly oxidized—there is no better red-lead obtainable than Dutch Boy red-lead. It comes in two forms—paste and liquid. The liquid (ready for the brush) is supplied in six different colors. The paste comes in natural orange-red, and can be shaded to dark colors. For information on special painting problems, write to our Department of Technical Paint Service, in care of our nearest branch.

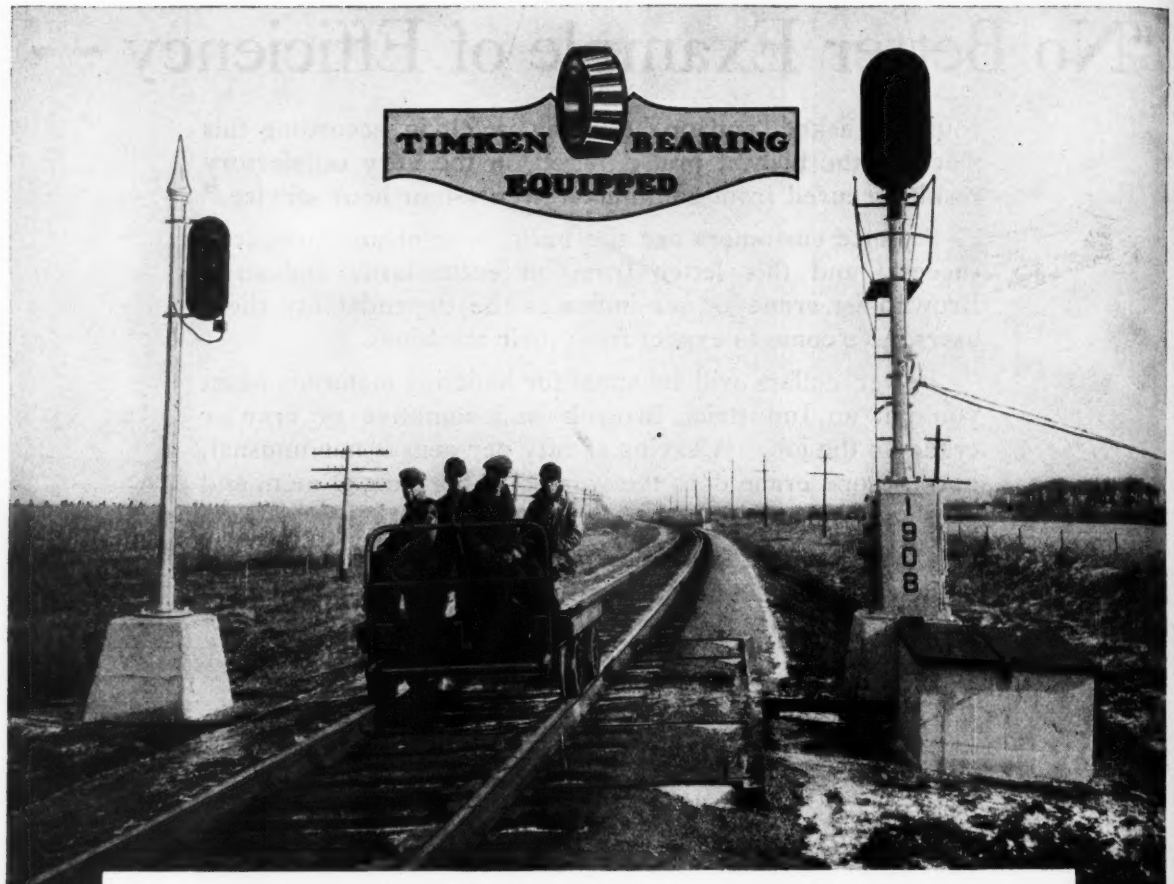
OTHER DUTCH BOY PRODUCTS

In addition to red-lead, the following products are sold under the Dutch Boy trademark: White-lead, linseed oil, flatting oil, solder, babbitt metal, lead pipe. The "Dutch Boy" guarantees high quality.

NATIONAL LEAD COMPANY

New York, 111 Broadway . Buffalo, 116 Oak Street . Chicago, 900 West 18th Street . Cincinnati, 659 Freeman Ave. . Cleveland, 820 West Superior Ave. . St. Louis, 722 Chestnut St. . San Francisco, 235 Montgomery St. Boston, National-Boston Lead Co., 800 Albany St. . Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Avenue . Philadelphia, John T. Lewis & Bros. Co., Widener Building.

DUTCH BOY RED-LEAD



Symbol Of Super Service In "Sheffield" Section Cars

Fairbanks, Morse & Company, Chicago, have taken full advantage of Timken benefits in their "Sheffield" line of section motor cars and trailers.

Both ends of the engine crankshafts in the motor cars are supported on Timkens, and the axles of the entire line of motor cars and trailers are also Timken-equipped.

Friction elimination, power conservation, lubricant economy and minimized maintenance, plus dependability under all conditions of service, are outstanding results of the exclusive combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken steel, in all classes of railroad rolling stock.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

Saves Jack Men — Saves Re-aligning Expense

THE Nordberg Power Jack, as you see it here, is raising a mile or more of track per day—and it is operated by one man! It is keeping well ahead of a tamping gang large enough to put up 6,900 feet of track in a single day. Twelve Jack Men with four hand jacks and four jack hole diggers would have a hard time equaling this record.

Re-aligning track behind the Nordberg Jack is easy and quick since the track is not thrown out of line while being raised. The shoe of the Power Jack is 6½ inches wide and 50 inches long, thus preventing tipping or kicking out—hence there is no tendency to throw track out of line as with hand jacks.

It will pay you to investigate the operation of this machine and the money it is saving many railroads in track maintenance work. Modernize your next year's track program by having one or more of these Jacks on every ballasting gang.

NORDBERG MFG. CO.

Milwaukee, Wisconsin

338 Perfect vs 15 Doubtful Tie Seats Adzed Per Man Per Hour

OPERATED by inexperienced men, under ordinary working conditions, the Nordberg Adzing Machines (illustrated above) averaged 338 PERFECT tie seats per hour—per man—per machine.

A few days before, on this same job, men adzing by hand had averaged 15 DOUBTFUL tie seats per hour, per man.

Regauging of rail after track is laid is not necessary with Nordberg Adzed ties. The rail sets level and stays level. With hand adzed ties, rails tip slightly, thus distorting the accuracy of the gauge and requiring one or two regauging jobs—with resultant spike-killing of ties.

Now is the time to think of next year's rail laying jobs. Here is a machine that will cut costs—but of even greater importance, is the kind of job that it does.

It will pay you to investigate. Full information and data on request.

NORDBERG MFG. CO.

Milwaukee, Wisconsin

KREOLITE

We Distill Our Own Creosote Oil

By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired. We have treated hundreds of millions of feet of timber in the past 17 years without a single instance of decay.

By the installation of the latest and most modern framing and boring machinery, we assure the purchaser of timbers most accurately framed at lowest cost.

Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill., (East St. Louis).

THE JENNISON-WRIGHT COMPANY, Toledo, Ohio

Branches in All Large Cities

R.R. TIES

No. 11 of a series

PUBLISHER OF
RAILWAY AGE
RAILWAY MECHANICAL ENGINEER
RAILWAY ENGINEERING AND MAINTENANCE
RAILWAY ELECTRICAL ENGINEER
RAILWAY SIGNALING
MARINE ENGINEERING AND SHIPPING AGE
THE BOILER MAKER

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

"THE HOUSE OF TRANSPORTATION"

PUBLISHER OF
LOCOMOTIVE CYCLOPEDIA
CAR BUILDERS' CYCLOPEDIA
RAILWAY ENGINEERING AND MAINTENANCE CYCLOPEDIA
BOOKS ON TRANSPORTATION SUBJECTS

NEW YORK 30 CHURCH STREET
CHICAGO 105 WEST ADAMS ST.
CLEVELAND 50 PUBLIC SQUARE
WASHINGTON 17TH AND H STS. N.W.
SAN FRANCISCO 215 MARKET STREET

ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: SUBSCRIPTION RENEWAL PERCENTAGE

October 31,1929

Dear Reader:
Everywhere

Every editor takes a keen interest in the subscription renewal percentage figure of his publication, for it affords him a measure of the extent to which he is meeting the needs of his subscribers. Careful buyers of advertising space look for the same figure when studying the relative merits of different papers. In a recent address before a group of business paper publishers, C. J. Stark, president of the Associated Business Papers, Inc., stated that "the renewal percentage determines how well a paper is doing its appointed job. I cannot help but believe," he continued, "that any business paper which continuously comes through with a renewal ratio of 55 to 60 per cent or better, is doing a real work. To my way of thinking, this registers reader interest, reader acceptance and reader prestige."

I believe that Mr. Stark has pointed out the true index of editorial efficiency. To ascertain how Railway Engineering and Maintenance measures up to this standard, we have analyzed our records for the year ending with June, 1929, and find that 79.54 per cent of all subscriptions that expired in this period were renewed. We find further that of the 4,500 subscriptions (4,444 to be exact) from railway officers above the ranks of foremen, that expired during this period, 96.31 per cent were renewed. The former figure exceeds Mr. Stark's yardstick by more than a third while we doubt if the latter figure has ever been equaled in the business paper field.

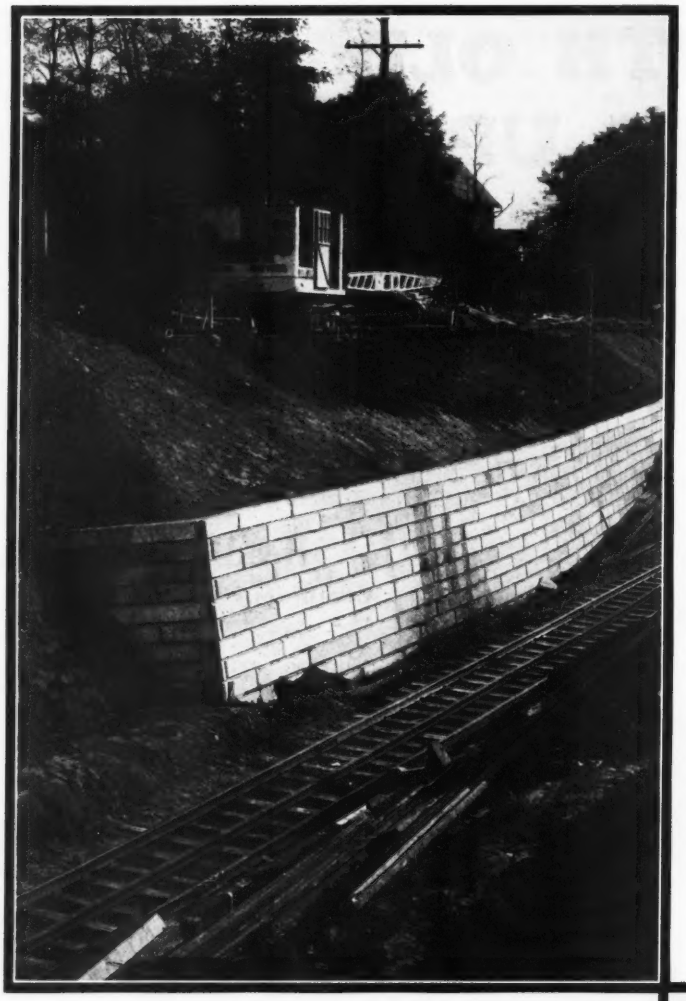
We are proud of this record because it indicates that you are pleased with our efforts to give you the kind of a paper that you want. It will be our aim during the months to come to so edit Railway Engineering and Maintenance that no alert railway maintenance officer can afford to be without his copy, and the only lapses will be those because of death or retirement.

Yours truly,

ETH:EW

Elmer T. Howson
Editor

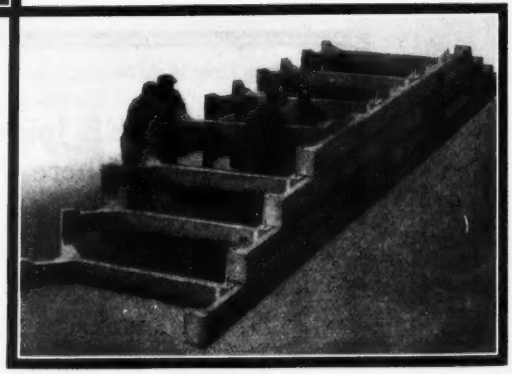
MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.



The *Long Island* finds 2-piece cribbing *particularly* advantageous

With a freight siding on top of the bank and a new depressed main right of way below waiting to go into service, it was necessary to install a good retaining wall quickly. Handling but two units direct from cars, the crew was able to erect the Federal wall shown, with no time lost in preparing forms or handling extra units.

Two-piece construction not only saves time and labor, but produces a strong, permanent, stable wall of masonry-like beauty, without maintenance. Federal retaining walls are in service on many leading railroads. Catalog on request.



Note the Y-shaped headers which interlock with the stretchers, holding the back-fill without the use of a third member in the bank. This results in a cellular wall of great strength and with no plane of cleavage in the bank.

FEDERAL CEMENT TILE COMPANY, 608 South Dearborn Street, Chicago, Illinois

Concrete Products for Over 25 Years

FEDERAL 2 piece Concrete CRIBBING

ELMER T. HOWSON, *Editor*
WALTER S. LACHER, *Managing Editor*
NEAL D. HOWARD, *Eastern Editor*
GEORGE E. BOYD *Associate Editor*

Railway Engineering and Maintenance

F. C. KOCH, *Business Manager*

H. F. LANE, *Washington Editor*

Name Registered U. S. Patent Office
Formerly the Railway Maintenance Engineer
Published on the last Thursday preceding the month of issue by the
Simmons-Boardman Publishing Company
105 West Adams Street, Chicago

CONTENTS FOR NOVEMBER, 1929

Editorials 479
The foreman—Winter rail laying—Uniform Employment—Can one man know it all?

How One Railway Feeds Its Men 482
Dining car and hotel department of St. Louis Southwestern replaces boarding contractor

A New Day in Maintenance 484
R. H. FORD *predicts greater uniformity in practice and a higher standard of efficiency*

Is a Uniform Force Practical? 486
What engineering and executive officers have to say on this much discussed problem

Bridge and Building Men Meet in the South 492

Report on Reducing the Cost of Maintaining Roadway Buildings and Small Stations

Report on the Selection and Training of Men for the Position of Foreman

Report on the Protection of Underground Pipe Lines from Deterioration

Report on Wearing Surfaces for Passenger and Freight Stations

Report on Relaitve Economy of Concrete Mixes and Practical Tests for Concrete Aggregates

Report on Water Transport Facilities for Railway Equipment

Report on the Elimination of Accidents to Men While Working off the Ground

Report on the Inspection and Maintenance of Track Scales

Exhibit of Bridge and Building Supplies

What's the Answer 512

With the Associations 519

Railway News Briefly Told 520

SIMMONS-BOARDMAN PUBLISHING COMPANY, Edward A. Simmons, *President;* Henry Lee, *Vice-President;* Samuel O. Dunn, *Vice-President;* L. B. Sherman, *Vice-President;* C. R. Mills, *Vice-President;* F. H. Thompson, *Vice-President;* Roy V. Wright, *Secretary;* and John T. DeMott, *Treasurer.*

Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

New York: 30 Church Street
Chicago: 105 W. Adams Street
Cleveland: Terminal Tower
Washington, D. C.: 17 and H Streets N. W.
San Francisco: 215 Market Street

Publishers also of
Railway Age — Railway Mechanical Engineer
Railway Signaling — Airway Age
Railway Electrical Engineer — The Boilermaker
Marine Engineering and Shipping Age
Railway Engineering and Maintenance Cyclopedia
Car Builder's Cyclopedia — Locomotive Cyclopedia
American Builder — House Furnishing Review

Member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. In sending us change of address please be sure to send us your old address as well as the new one.

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

Railway Engineering and Maintenance

Volume 25 November, 1929 No. 11

Labor Saving Equipment

IN A PAPER presented before the recent convention of the Roadmaster's Association and published in the October issue of *Railway Engineering and Maintenance*, page 541, M. M. Backus, assistant chief engineer maintenance of way of the Illinois Central, stated that the railways are now expending for labor-saving equipment, including interest on investment, repairs and depreciation, an amount sufficient to pay the wages of more than 80,000 men. In other words, this equipment must do the work of a force of at least this size to justify its use. That it does this and more is so evident as to require no argument.

Since there has been little or no reduction in the number of men employed in the maintenance of tracks and structures on the railways of the country as a whole in recent years, it is evident that, but for this equipment, the forces required to maintain the property to the present standards would necessarily have been increased by this number, and in many localities it is doubtful if the added men could have been secured, particularly since much of the work now done mechanically was of the most laborious character, as for instance, the pumping of a hand car.

The development of machines to do such work as the handling of rail in relaying operations, the tamping of ties and the mowing of the right of way, has done much to remove the drudgery from maintenance of way work and to make it not only less arduous but also of a character that requires more skill. As such, it is making employment more attractive, thus tending to draw a more intelligent and enterprising class of men into the service of the railways.

Few maintenance of way supervisors or foremen would be willing to return, if they could, to the methods in vogue a generation or even a decade ago. Modern industrial life is making more exacting demands on all classes of work today, from which trend the railways are not exempt. The maintenance of way department has been able to meet these demands with reasonable efficiency only by the utilization of these new aids. That this trend will continue is self-evident. That supervisor and that foreman will profit most who utilize these aids as fully as possible in lightening their burdens.

Keeping Pace with Industry

Since January 1, 1923, the railways of the United States have expended approximately $5,790,000,000 for improvements and additions to their properties. In this period they have placed in service, new or rebuilt, 770,609 freight cars and 14,234 locomotives. The average tractive power of the locomotives in service has been increased from 36,365 lb. in 1920 to 43,845 lb. in 1928, while the average capacity of freight cars has risen from 42.4 to 45.8 tons. The average speed of freight trains has been increased from 10 miles an hour in 1920 to 13 miles in 1929, while the average number of cars per train has been increased from 37 to 50. Fuel consumption per 1,000 gross ton miles has been reduced from over 160 lb. to about 125 lb. These figures afford a measure of the improvements in service and efficiency that have been effected by the railways and that have in turn aided in quickening the pace of industry.

The Foreman

THE fact that the Roadmasters' and the Bridge and Building associations both considered reports at their recent conventions dealing with the problem of selecting and training foremen, indicates the appreciation of the members of these associations of the fact that the foreman is the key to the efficiency of their organizations. It is doubtful if there has ever been a time when the maintenance foremen have been of as high calibre as today. The very nature of their work demands this, for more is expected of them now than ever before. Yet even more will be required of them in the future.

The fact that supervisory officers are considering means for selecting foremen more carefully and of training these men more thoroughly in their duties, indicates that they are awake to the trend of the future. The solution of this problem rests in part with railway managements, for on them depends the inauguration of such measures as the creation of the position of assistant foreman, etc. However, much can be done by local supervisory officers in giving more care to the selection of the men for their gangs, in training them adequately and in stimulating them to their best efforts. The type of foremen found on a division affords no mean index of the character of the supervisory officers. Maintenance officers have no more important task than the building up of an efficient force. The foremen is the key man in this force.

Winter Rail Laying

DESPITE the fact that many track men still contend that it is not practicable to lay rail during the winter months, the number of roads that order their rail during the fall is growing steadily. This has been particularly evident during recent weeks, when roads whose requirements approximate one-

half of the year's total have ordered more than one million tons of rail for laying during the late fall and winter. Among these roads are the country's two largest systems, the Pennsylvania and the New York Central, which alone have ordered more than a half million tons.

It is not many years since it was the almost universal practice of the roads to order their rail in the late winter and early spring for delivery throughout the summer and early fall and then to crowd much of the work of laying it in tracks into the autumn. Yet when the roadmasters went through one of the steel mills at the time of their convention last September, this mill was hard pressed for rails to roll, as it had completed its 1929 orders several weeks before.

All of these developments go to show that, regardless of academic discussions, the idea of laying as much rail as possible during the slack winter season is gaining ground and the indications are that the time is not far distant when this practice will be well nigh universal.

Profiting from Experience

THE railways are now bringing to a close one of the most active seasons of maintenance of way work in their history. The expenditures for this purpose, as contrasted with those for improvement chargeable to capital account, approach if they do not exceed those of any previous year, while with the increased purchasing power of the dollar, and the growing efficiency of labor, the amount of work done is even greater.

At the end of such a season, one may well take stock of the year's work to ascertain wherein it may be improved during the next year. New equipment and materials require changes in established methods. Have these changes kept pace with those in materials and tools? Are these methods capable of still further improvement? Wherein can the delays of the last season be eliminated? Can the output be increased or the work made less burdensome by the utilization of a new unit of equipment? In other words, that road, that division or that section will show the greatest progress on which the man in charge surveys the present year's work critically to see where he can improve it next year. Now is the time to make such a survey while the details are fresh in mind.

Modern Turntables

DEVELOPMENT in industry takes place so rapidly in these days that new practices and uses become established almost without notice. An apt illustration of this is afforded by the railway turntable. For years, it was of the balanced type, in which no load was carried on the end wheels while the table was being turned. But about seven years ago, two new types were introduced in which the load is distributed between the center and the ends under all conditions. One of these consists of twin, simple-span girders and the other of girders that are continuous from end to end as in the older form of turntables, but each is equipped with heavy carriages to support the end concentrations while in motion.

The power required to operate these new tables is appreciably greater than that needed to turn the old balanced tables, but the inherent advantages of the newer types are such as greatly to offset the disadvantage of greater power consumption. As a result, the new tables became popular at once and it is significant that fully 80 per cent of the recent purchases of turntables specify one or the other of the new models.

The question naturally arises as to why the ideas embodied in this new equipment were not applied sooner, as the principles involved are exceedingly simple. The answer probably lies in the lower cost and greater reliability of power, the contingency of turning by manual power during a current failure or breakdown being no longer the vital consideration it once was. This fact is exerting a profound influence in all industry and in no less degree on the railways.

Can One Man Know It All?

THE safety agent, the fuel supervisor, the claims prevention officer, the motor car maintainer and the work equipment superintendent are all creations of more recent years, born of a realization that the business of railroading is becoming complex. It has come to be understood that certain operations require the assigment of men to special duties, that they may become experts in their line and concentrate their energies on the needs of rather restricted fields. This increasing complexity of railway transportation extends into the individual departments of railway service. Thus, in the maintenance of tracks, some railroads have found it necessary to create special assignments for the study of rails, the treatment and care of crossties and even the protection of embankments from stream erosion. But in no department do the duties of an officer now call for a more diversified knowledge than in that embraced in the designation "bridges and buildings."

Until about 15 years ago, the construction, operation and maintenance of water service facilities were generally included among the duties of the bridge and building organization, but with the increased attention to water treatment, the replacement of steam engines by gasoline and oil-burning engines and electric motors for the operation of pumping plants, and the more exacting requirements of water supply, the railroads have seen the wisdom of centering the responsibility for water supply facilities in a special staff. But even with water service excluded, bridge and building maintenance embraces a field of ever-increasing diversification and complexity.

In the case of bridges, development has been confined in large measure to a greater refinement in practice. It is now generally recognized that the making of good concrete calls not only for the use of cement aggregates and water, but also another ingredient—a real knowledge of the technique of concrete. Wood can no longer be cut and framed at random, but must be preframed before treatment, a procedure calling for greater detail and accuracy in plans.

But it is, after all, in the field of buildings that the greatest changes have taken place in recent years, a fact which may well be illustrated by comparing almost any type of modern building with its counterpart of 30 years ago. Not only are a greater variety of materials being used in the construction of the shell, i.e., the floor, walls and roof, but the modern building is provided with facilities for sanitation, heating, ventilation, lighting and power, that were found only in their most primitive form in the building of the last century. In addition to the service facilities of these various classes, the building officer on a railroad must deal with many facilities that are peculiar to the railway industry, such, for example, as modern coaling stations, turntables and those fea-

tures of enginehouses that have no counterpart in the usual industrial building.

To meet the needs of this complex field, most railroads have effected a considerable degree of departmentalization, such as the separation of the duties of the bridge engineer from those of the architect or building engineer. Moreover, on the larger railroads, the staff of the latter often includes a power-plant engineer, a heating and ventilating expert, etc. However, in the actual administration of the operations of the division, the responsibility generally rests on one man, the bridge and building supervisor.

While it is clear that these supervisory officers have shown a keen appreciation of their growing responsibilities and have been eminently successful in meeting the greater demands imposed upon them, it is not entirely beside the point to question whether the present plan of organization fulfills the requirements of the day as effectively as it should. The prevailing plan has worked well for so many years that it would be difficult even to suggest a substitute for it. One way out may lie in the separation of the division bridge work from the building work, as is done on some roads. Another might be the assignment of the more special duties to system organizations, as is now done in the case of track scales. However, the question raised above is not intended as an indictment of the bridge and building officer or a criticism of the present organization, but constitutes a plea for a thorough investigation of present methods and policies for the purpose of ascertaining whether they are the best and what improvements, if any, can be made to meet the growing demand.

Uniform Employment

IN RECENT years, the exacting demands for service and the constant pressure for higher efficiency and greater economy that have been made upon the railways have brought about the necessity for a corresponding change in methods, if these demands are to be met. For this reason progressive railway officers are considering more intently than ever before how they can increase the efficiency of their maintenance operations. This has already been done to a considerable extent by the introduction of mechanical equipment of many types.

The introduction of mechanical methods to supplant the slower and more expensive method of hand work has created another situation, however, since the operation of these tools requires the services of trained workmen, if best results are to be obtained from their use. It is becoming increasingly difficult to secure men who are adequately trained in the operation of these tools, so that many roads are making it a practice to retain a number of their skilled operators through the winter in order to be assured of their services during the following season, thus increasing the number of men who are given permanent employment.

Practically every maintenance officer is aware of the waste which is inherent in the present system of seasonal work, in which large numbers of men are hired early in the spring and laid off upon the approach of winter. When the new forces are added at the beginning of the season, time is required for their organization, during which period the amount of work which they do is considerably below the average that may reasonably be expected later; likewise the number of personal injuries is greater during this early period, all of which factors tend to increase the cost of seasonal work.

For these reasons the question of employing uniform forces throughout the year for all classes of maintenance of way work is being given increasing attention among railway officers. As yet considerable difference of opinion exists upon the subject. Most officers recognize that there are many advantages in such a practice, but many of them are also of the opinion that there is no economy in it, since they are confronted with severe winter conditions when, as they say, little or no maintenance work is possible. In other sections, where winter conditions are less severe, uniform employment of the maintenance forces is an established practice and the officers of these railways are almost unanimously in favor of such a system. So far only one road, upon which winter conditions are severe, has made an extensive trial of permanent employment for its maintenance forces, but the results which it has obtained in increased efficiency and reduced costs are well worth serious study.

That there is a definite trend toward stabilization of the maintenance of way forces through uniform employment throughout the year is indicated by the comments of railway officers, which are given in the article which appears on page 486. It is also evident that while most of them realize that the present system of seasonal employment is uneconomical and inefficient, some are reluctant to apply the practice. This attitude is easy to understand, since the adoption of a uniform force will necessitate an almost complete change in the methods which are now being followed. Despite this attitude, however, the benefits of such stabilization are too great to be ignored, and a movement which is fundamentally sound, cannot be held back because of difficulties in its application, or because it will require a change in methods.

It is the experience of every industry that permanent employment increases the efficiency of the workmen and, therefore, produces more economical operation, while it also results in a higher type and better satisfied body of employees. On the other hand, periodical interruption of any operation brings about waste, lack of interest and low efficiency on the part of the workmen, and reduces both the quality and quantity of the work performed.

A further powerful influence which is working toward this end, is the awakened and intelligent thought on the part of progressive railway management that it has an obligation to society to stabilize employment and better working conditions so far as possible, and that, from an economic standpoint, there are advantages in stabilization which will result in improved production at less cost. This appreciation has stimulated efforts to deal with the subject in a constructive manner, so that it seems probable that the movement which can now easily be discerned, will gather momentum rather than recede.

A D. & R. G. W. Train Running Over a Section of Relocated Line

How One Railway Feeds Its Men

St. Louis Southwestern places dining car and hotel department in charge of boarding laborers in extra gangs

THE St. Louis Southwestern, in 1923, took over the operation of its boarding camps for extra gangs on track work, which, prior to that time, had been operated by the commissary contractor who recruited the labor. This step was taken on the threshold of an extensive program of improvements and the change was made in order to better conditions among the extra-gang laborers, as well as to fit in with the policy of the road to control all phases of its operations. The camps are in charge of the dining car and hotel department, while the sanitary department is responsible for the maintenance of the camps in proper condition to protect the health of the men.

Sixteen Camps Are Being Operated

At the present time, 16 camps are operated, housing about 750 laborers. Two of the gangs are composed of Mexicans, while the remainder are made up of Negroes. During the five-year period ending April 30, 1929, a total of 2,557,986 meals had been served. During the same period, supplies to the amount of $477,796.94 were purchased for the extra gangs, while the payrolls of the dining car department chargeable to these activities were $247,823.

Providing food for these camp outfits entails the purchase and shipment of large quantities of provisions, about 90 per cent of which are obtained from firms located on that road. During 1929, it is estimated that the extra gangs will consume the following supplies:

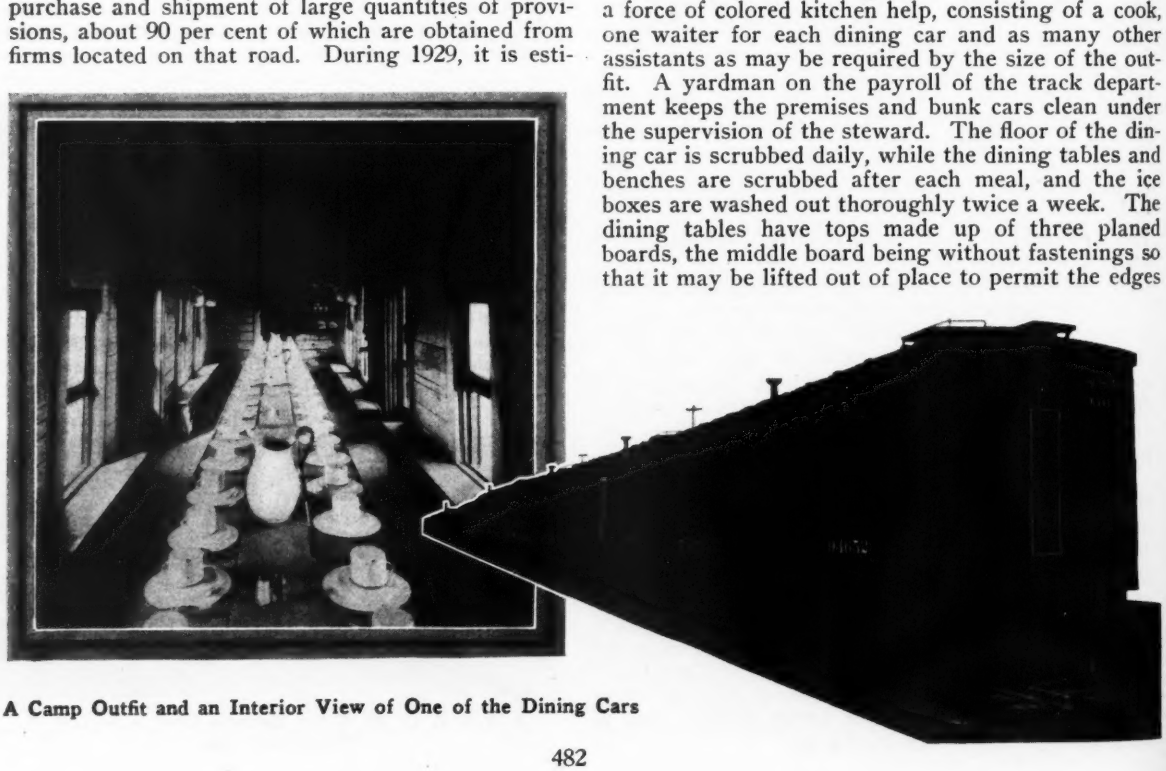
Fresh meat	140,000 lb.	Cabbages	30,000 lb.
Salt meat	125,000 lb.	Tomatoes	16,000 lb.
Flour	225,000 lb.	Evaporated fruits	125,000 lb.
Cornmeal	40,000 lb.	Sugar	37,000 lb.
Baking powder	8,500 lb.	Coffee	12,000 lb.
Potatoes	230,000 lb.	Salt	175,000 lb.
Hominy	50,000 lb.	Syrup	62,500 lb.
Onions	125,000 lb.	Eggs	25,000 doz.
Beans	40,000 lb.		

A charge of 30 cents is made for each meal and no charge is made for the use of the bunk cars. Payment is made by payroll deductions. While the margin of profit is small, the profits are sufficient, in the aggregate, to offset the losses sustained by the operation of dining cars.

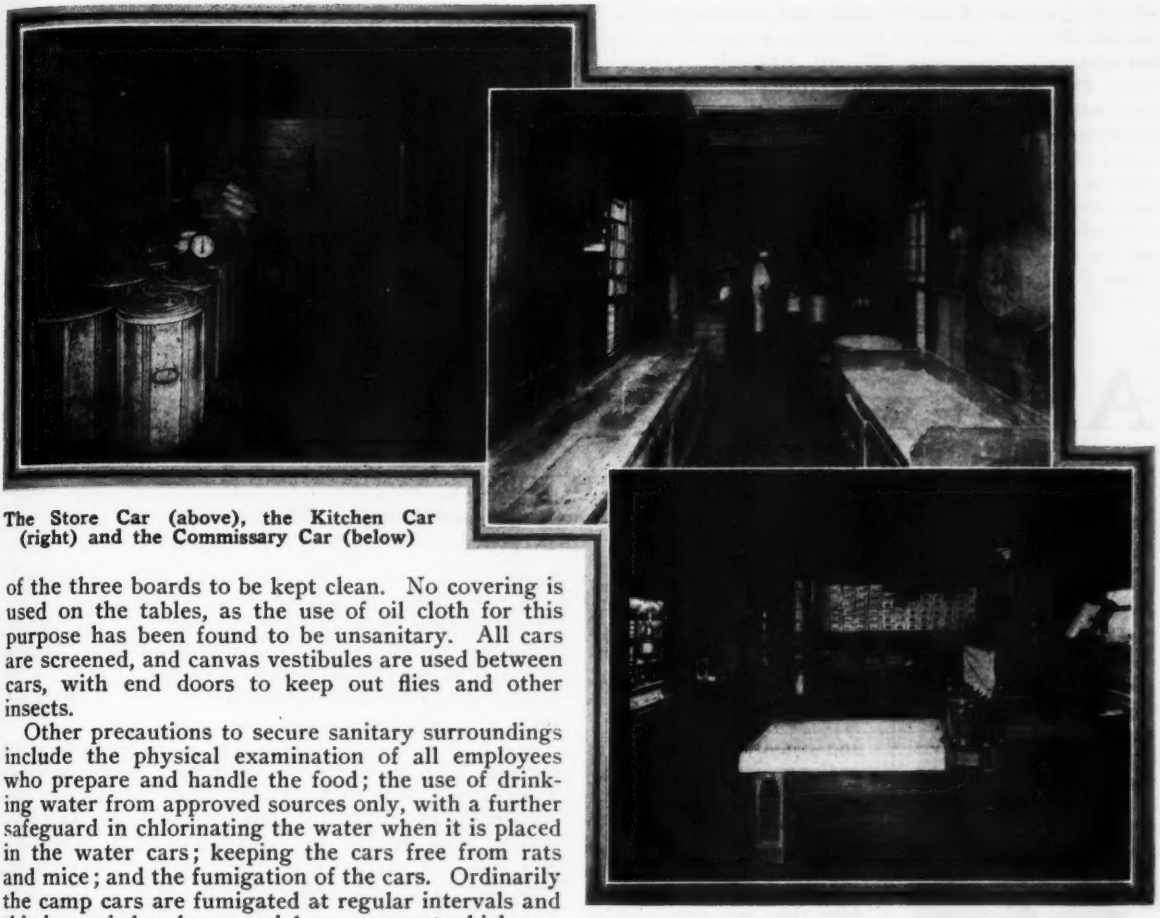
In addition to furnishing meals for the men, a commissary is provided at each camp, in charge of the steward, at which are sold cigarettes and other tobacco, as well as articles of clothing, which experience has shown are most in demand by the laborers. In the course of a year, the commissary sells, among other supplies, 2,500,000 cigarettes and 2,500 pairs of shoes.

Each Camp Is in Charge of a Steward

Each camp is in charge of a white steward with a force of colored kitchen help, consisting of a cook, one waiter for each dining car and as many other assistants as may be required by the size of the outfit. A yardman on the payroll of the track department keeps the premises and bunk cars clean under the supervision of the steward. The floor of the dining car is scrubbed daily, while the dining tables and benches are scrubbed after each meal, and the ice boxes are washed out thoroughly twice a week. The dining tables have tops made up of three planed boards, the middle board being without fastenings so that it may be lifted out of place to permit the edges



A Camp Outfit and an Interior View of One of the Dining Cars



The Store Car (above), the Kitchen Car (right) and the Commissary Car (below)

of the three boards to be kept clean. No covering is used on the tables, as the use of oil cloth for this purpose has been found to be unsanitary. All cars are screened, and canvas vestibules are used between cars, with end doors to keep out flies and other insects.

Other precautions to secure sanitary surroundings include the physical examination of all employees who prepare and handle the food; the use of drinking water from approved sources only, with a further safeguard in chlorinating the water when it is placed in the water cars; keeping the cars free from rats and mice; and the fumigation of the cars. Ordinarily the camp cars are fumigated at regular intervals and this is carried on by a special arrangement which permits the work to be done at the rate of three cars a day.

In order to insure that these regulations are carried out, the dining car and hotel department has a general inspector and two traveling inspectors who keep in close touch with the camps, visiting each one at least once a week. One of the traveling inspectors is assigned to the territory south of Texarkana, while the other looks after the outfits north of that point. The inspectors make daily reports on printed forms, to show the conditions prevailing at the camp as to cleanliness, quality of the meals and stocks of commissary supplies on hand, together with other pertinent information. Inspectors from the sanitary department also visit the camps regularly, recording their observations on score cards which assign different weights to the various elements for which the commissary department is responsible, such as the cleanliness of the camp and surroundings, the storage of food supplies and the lavatory facilities. Similar scores are recorded for the elements for which responsibility rests with other departments of the road, these including the physical condition of the cars and furnishings, together with the source and handling of the water used for drinking and culinary purposes.

The care exercised to keep the food clean and wholesome in the camps extends to its shipment to the point of consumption. Shipments of dry groceries are made in supply cars monthly, while meats are shipped in refrigerator boxes two or three times a week. Where the distance is too great for one icing, these boxes are re-iced en route by company employees. Supplies are selected so that the men may have a variety in their diet, and by close cooperation between the stewards, the extra gang foremen, the inspectors and the men themselves, an effort is made to provide the men with what they want to eat, as far as is consistent with good practice. Racial preferences are recognized in supplying the food and also in its preparation, the Mexicans liking their dishes highly seasoned. In addition to these arrangements, every effort is made to have the meals hot when they are served.

Make-Up of Camp Trains

In fitting out these camps, the railway provides cars equipped to standard plans. The interiors are ceiled and the floors are covered with D. & M. flooring. The make-up of the train varies with the size of the gang, as do some of the individual cars in the train. Thus, for a gang of 84 laborers, 17 cars are provided, consisting of the following, in the order as shown: 1 water car; 1 foreman's office and sleeping car; 1 foreman's dining car, which is divided at the center to provide a dining car for the foreman at one end, with bunks for the cook and kitchen help at the other; 1 dining car for laborers; 1 kitchen car; 2 dining cars for laborers; 1 store car; 1 commissary car; 7 bunk cars, with double-deck bunks to accommodate 14 men each, and 1 tool car. For smaller gangs, the foreman's car is arranged as an office car, with a double-deck bunk, and a dining room partitioned off at one end. Similarly, differ-

ent plans are used for the store and commissary cars, a combination store and commissary car being used for gangs of less than 24 men, while for gangs of from 25 to 70 men, one end of the store car is partitioned off to provide sleeping quarters for the kitchen help. In all cases the commissary car contains bunks for the steward. No cars less than 32 ft. long are used, while for the store cars and bunk cars, only cars more than 32 ft. in length are used.

The results obtained have been satisfactory alike to the men and the railway. That the men appreciate the quality of the food and the way it is prepared and served is evidenced by the fact that the labor turnover has been greatly reduced in spite of a heavy working program, and that there is very little seasonal fluctuation in the supply of labor, this latter being of particular value on a road where work is carried on throughout the year, as it is on the Cotton Belt.

We are indebted to C. H. Jennings, superintendent of the dining car and hotel department, of the Cotton Belt, with headquarters at Texarkana, Ark.-Tex., for the information from which this article was prepared.

A New Day in Maintenance*

By R. H. FORD

Assistant Chief Engineer, Chicago, Rock Island & Pacific, Chicago

R. H. Ford

RAILWAY maintenance consists fundamentally of three closely related but nevertheless distinct functions, namely: keeping the roadway in its present state, and usually referred to as ordinary maintenance; replacing wornout parts by better parts; and substituting parts which while still serviceable have become obsolete or inadequate before they are worn out in service, usually because of advances in the science of transportation. An intelligent understanding of these differences and their relation to the property, has become increasingly important in recent years and will continue to be even more important within the next 10 years because of the trend of the times in modern industry.

The railway industry of 1929 has little resemblance to what it was in 1890. It has in fact already greatly changed since the period of federal control. An analysis of the reasons for this will, I think, show conclusively that while we railway men can pride ourselves on what has been accomplished in recent years, the fact remains that the underlying cause has been the influence of the even greater advances that have occurred in the other major industries. As will always happen when you get a better understanding of the views and problems of others, we of the railroads have obtained in recent years a much better and more diversified knowledge of the requirements of industry, which in turn has enabled us to apply the results to the making of a better success of our own business.

Have Obtained a Better Knowledge

I have referred to one of the principal functions of maintenance as the substitution of parts which have become obsolete or inadequate before they have become worn out in service. Practical application of this feature has served at times as a sort of two-edge sword, either in permitting extravagance through the substitution of facilities not presently justified or in serving at times to justify the undue retention of obsolete or inadequate parts where service life had not yet expired, under the guise of economy.

While it is doubtless true that many conditions of the past have contributed to make such things possible, I am persuaded that the results of our rapidly advancing conditions in industrial relations, will operate in the future more readily to make undesirable retentions and unsound expenditures more readily ascertainable than they have been heretofore. We railroad men must have well in mind that other important forms of national transportation are now competing with the railways for traffic, namely: the highways, the waterways, and the airways, and what is more to the point, they have been one of the principal factors in compelling the railroads to speed up traffic if they are to continue to hold their place as the principal transportation agency. It is through this action that a hitherto unexplored field is about to open up for railway engineering and maintenance.

Modern Tendencies in Locomotive Design

I refer to modern tendencies of locomotive design and the influence which it is now exerting and will continue to exert on axle loading, and in turn to the powerful and reactive influence that this must have on maintenance of way and structures. Under the practice which has prevailed for many years in rail transportation, the requirement upon locomotive design has been for heavier locomotives, with increasingly greater concentrated axle loads; low driving wheels and relatively slow speed requirements, on the theory that the cheapest and most economical transportation was obtained by increasing the number of heavily loaded cars behind the tender.

But under the influence of dependable and safe movement has come the insistent demand for greater speed, less road time and less terminal time, meanwhile coupled with the absolute necessity imposed upon railway managers for reductions in operating costs irrespective of the mounting charges for labor and material. Meanwhile there have been demands—I could almost say commands—from the traffic departments

*Abstracted from a paper presented before the convention of Roadmasters and Maintenance of Way Association at Chicago on September 18.

that greater effort is necessary if they are to hold the business against the inroads of the subsidized waterways and highways.

Will Influence Maintenance of Way

Slowly perhaps, but all the more surely, all of these factors have served to accelerate advances in locomotive design and which will, I believe, exert a profound influence in the future of railway maintenance. There are unmistakable evidences that radical changes are already on the horizon and that locomotives procured for replacements will not be designed or rebuilt along existing lines or from existing plans. There is a tendency to obtain increases of locomotive effort by more nearly equalizing the driving wheels of both freight and passenger locomotives through increasing the size of the freight engine driving wheel.

Investigations show that since 1888 the increase in the tractive power and weight of our locomotives increased rapidly from year to year, but in the last few years there has been a decided recession. The indications are now that we will not advance much above present weights. Rather, it seems that the conditions under which efficient power will be developed are those which provide greater hauling power with even lower driving axle loads than are even at present anticipated. I think I am safe in saying that we have about reached the peak of axle loading in so far as motive power is concerned.

Wheel Loads Will Not Increase

While there is a marked tendency for increased capacity for locomotive tenders, the extra weight is being distributed over 12 instead of 8 wheels, and this points to the same development for hopper or gondola cars, so that even with greater capacity, their axle loads will not be any greater, and in fact may be less, than on the 8-axle cars. For other types of equipment, such as box cars or passenger equipment, the maximum loading conditions have now about reached their economical limit.

In other words, while the speed will increase, this will not be met by increases in axle loading or an increase of impact on the track structure. Rather, the tendency will be for a decrease through the securing of better counterbalancing and distribution of weight.

Stabilization of concentrated loads on the track structure, and a clearing up of the affects of impact, will sooner or later be possible as the result of the research work of the Committee on Stresses in Track of the American Railway Engineering Association, under the able leadership of Professor A. N. Talbot of the University of Illinois. Its advent will open up unheralded opportunity for maintenance of way officers. With the possible exception of the yet uncharted fields of traffic, I am convinced that no place in railroading offers such opportunities for advancements and reformations in maintenance of way practices through the medium of decreased use of labor and materials and changes in our present transitory methods of their use, as well as through the development of new uses for machinery and mechanical appliances in construction and maintenance.

The Advantage of Stabilization

The problem that will soon confront the maintenance of way officer is to be prepared to take advantage of the reduction in maintenance of way expenditures, made possible by the stabilization of locomotives and cars, a thing which in the history of railroading has never before been within the reach of possibility.

I have referred to the release of items of property before they have served their service life largely because of obsolescence and inadequacy. The principal contributing cause of this has been advances in equipment weights and locomotive design. No sooner have track structures been built than it has been necessary to alter, strengthen, replace or renew rails and fastenings, ballast, bridges, ties and other fixtures to meet the increasingly heavy axle loadings long before service life had expired. This of itself has contributed powerfully to the practice of the American railways to temporize with facilities and build only for the present. It has affected the use of labor and materials to a greater degree than the average person realizes.

Stabilization and uniformity of requirements upon structures will, I am convinced, ultimately effect a complete change in policy and practices in this respect, permitting a greater degree of permanency, and with it the use of better and more scientifically designed appliances, requiring better materials, less labor and a simpler and more concentrated supervision, and a different character of supervisory forces. It will also, in turn, tend to effect a greater reduction in charges for depreciation and retirement.

Standardized Track Structure

Stabilization of locomotive and equipment loadings will enable better uniformity and increased standardization in the track structure. It will permit a more precise knowledge of the character of ballast requirements and consequently the development of ways for its conservation. It should eliminate the necessity of vast expenditures for subsurface improvements and drainage caused by deformations of the roadbed, much of which can be traced to unequal pressure on the subsoil through unequal and excessive superimposed loads, to which I have previously referred.

Standardization to a point not now possible, through simplicity of design and interchangeability of parts on a scale not yet even attempted and embracing all forms of railway maintenance, will soon be practicable. Few persons who have not intensively examined the subject, realize the great possibilities in this direction.

The Opportunities

The following figures will give an index of the opportunities in this direction:

Approximately 25 per cent of the employees of our railroads are in the maintenance of way department. Of these, 83 per cent are employed on the track, largely in common or semi-skilled labor. Our expenditures for the upkeep of the track is approximately 78 per cent of the total outlay for maintenance of way and structures. Of the total expenditures for labor and material, approximately 53 per cent is for labor and 47 per cent for material. The maintenance of way and structures expenditures account for a little less than 14 per cent of the total operating revenues on the Class I railroads in the United States, while maintenance of equipment consumes 19¾ per cent, with 34¼ per cent for transportation. The influence of a more permanent way, rendered possible as aforesaid, will also permit reductions in transportation and mechanical expense, and especially the latter.

We can not even hazard a guess at what the future holds out in this direction, but it is safe to say that there are possibilities, and in proportion to the possibilities there are the opportunities both individually and collectively. Not only are they possibilities for the railway maintenance of way men of today but they stretch out infinitely greater for his successor of tomorrow.

How many of these men, who will be laid off in the fall, will return in the spring

Is a Uniform Force

A resume of the current thought of engineering and executive officers on this much discussed problem

IS THE employment of a uniform force throughout the year practical in the maintenance of way department and, if so, can this form of stabilization be justified on the grounds of economy or greater efficiency? Although wide differences of opinion prevail on this question, it is a subject to which both maintenance and executive officers of the railways are giving serious attention. The emphasis which President Hoover has placed on permanence of employment in industry, as well as the comments of railway officers themselves, indicate the growing importance of this subject.

Since such wide differences of opinion do exist among railway men as to the extent to which permanent employment is practical for the maintenance forces, and in the belief that an exchange of ideas at this time will be constructive, a questionnaire, designed to bring out a thorough discussion of the different phases of the subject was sent to 58 chief engineers and engineers maintenance of way. Replies were received from officers having jurisdiction over more than 170,000 miles of line, representing every section of the United States and Canada. In addition, testimony given by executive officers of the railways before the Committee on Education and Labor of the United States Senate, which has been making an investigation of unemployment in the United States, has been studied to determine more definitely the trend of thought among these officers.

Railways Fall into Three Groups

In classifying the replies, it is at once apparent that the practices which are being followed in different sections of the country differ widely and that the attitude of railway officers toward the practicability of a uniform force is influenced somewhat by their personal experiences. In general, there are three more or less distinct groups, based on geographic location or climatic conditions. Two of these are sharply defined, while the third group merges to some extent into the other two.

The replies indicate that in the south and southwest sections of the country the practice of employing a uniform force throughout the year is well established and has been in effect for as long as 25 years and even longer on some roads. In these sections, where variations do occur in the number of men employed, the minimum force is usually worked during midsummer, when the extreme heat makes it impossible for the men to exert themselves enough to work efficiently, or during the cotton picking and cane cutting season or when other crops are being harvested. With practically no exceptions, this group favors the employment of a uniform force and believes that it results in increased efficiency and greater economy.

The reverse of this attitude is found in the northern states and Canada where the bulk of the year's work is done in the period between April and October, the maintenance forces being augmented during this period to correspond with the amount of work to be done, and reduced to a "winter basis" not later than December 1. A study of the replies indicates that this method of handling the maintenance forces is generally accepted as necessary and that the opinions of the maintenance officers in this group are influenced somewhat by the fact that few of them have had any personal experience with a uniform force, although many of them are now doing work during the winter months that was considered impractical if not impossible a decade or more ago. Almost without exception, the officers in this group expressed the opinion that the employment of a uniform force would lead to greater efficiency, but that the climatic conditions with which they have to contend are such that the practice can not be followed with economy.

The third group is found in the zone which lies between these two extremes, where severe winter conditions do not obtain and where the summers are longer but otherwise more nearly comparable to those in the northern section. In this zone, although

The primary problem is to provide useful employment for the men in winter

Practical?

"open winters" seldom occur, snow is not a serious problem and frost does not penetrate deeply, but the greatest difficulty is experienced with alternate freezing and thawing. In this group there is less unanimity of opinion as to the practicability and economy of a uniform force, but, in common with the other two groups, there is a definite belief that increased efficiency will result from stabilization of the maintenance forces.

Uniform Force Is Maintained on Southern Lines

In answer to the query whether they consider uniform forces practical in the territory served by their lines and to what extent the practice prevails, J. F. Burns, assistant engineer maintenance of way, Louisville & Nashville, R. H. Gaines, engineer maintenance of way, Texas & Pacific, W. G. Brown, engineer maintenance of way, Florida East Coast, E. A. Craft, engineer maintenance of way, Southern Pacific Lines in Texas and Louisiana, W. A. Spell, engineer maintenance of way, Atlanta, Birmingham & Coast, J. E. Willoughby, chief engineer, Atlantic Coast Line, and J. L. Kirby, engineer maintenance of way, Seaboard Air Line, replied that a uniform force is entirely practicable for their lines. Messrs. Burns, Gaines, Willoughby and Kirby advise that their maintenance forces do not fluctuate from month to month or with the seasons. Messrs. Spell and Craft said that there is some fluctuation during the crop season, owing to the absorption of labor by this industry. Mr. Brown states that the maintenance forces are allotted monthly on his road, and that this allotment depends upon the revenue prospects, but that there are no fluctuations because of seasonal or traffic reasons.

W. P. Wiltsee, chief engineer of the Norfolk & Western, maintains a uniform force, except for a few weeks on the northern part of the line, where severe winter weather hampers maintenance work somewhat. Except for this comparatively small part of the mileage, a uniform force is maintained except for such differences as are necessary to correspond with variations in annual programs for ballasting, rail laying, painting, etc. Hunter McDonald, chief engineer of the Nashville, Chattanooga & St. Louis, finds it practical to maintain a force so nearly uniform that the variation between the months of greatest and least employment does not exceed seven per cent.

On the Kansas City Southern, according to A. N. Reece, chief engineer, the section, bridge and building and engineering forces are maintained uniformly. At present, extra gangs are reduced in size, but not in number, during the winter. The maintenance practices are being revised, however, with the purpose of establishing uniform forces in all branches of the maintenance organization, in the belief that it will increase the efficiency of these forces.

C. E. Weaver, chief engineer of the Central of Georgia, says that, "We work practically a uniform force throughout the year. Occasionally we reduce the force as much as 10 per cent from November 1 to April 1, but never more than that amount. In our territory, general trackwork can be prosecuted with the same advantage during the winter as in the summer, except on minor branch lines that are not ballasted. Maintaining a uniform force is not a new practice with us, but has been in effect for years. We find that it has many advantages and no disadvantages."

These replies are typical of the opinions of the first group that, in the southern territory, a uniform force is not only practical but that it notably in-

What They Are Thinking

There is a constant and imperative demand for greater efficiency in the maintenance of way organization, and this has been growing rapidly in the past few years, owing to the notable increase in machine equipment for the performance of maintenance operations. There is also a demand for greater economy in maintenance work and, since railway officers are aware of the waste in the present system of seasonal employment, they are giving more serious thought to the possibilities of uniform forces. The accompanying article is a discussion of the question by railway officers and shows the present trend of thought on the subject.

creases the efficiency of the men who are employed. W. G. Brown expresses the thought of this group on the benefits that result from the practice, by saying that, "It creates permanent employment, which in turn reduces the supervisory and labor turnover, affords time and opportunity for a better selection and proper training of the men in the department and provides for maximum efficiency through survival of the fittest."

Northern Group Believes It to Be Impractical

As contrasted with the group representing the southern territory, C. B. Brown, chief engineer operation, Canadian National, and P. C. Newbegin, chief engineer, Bangor & Aroostook, voice the opinion of the more northerly roads. Mr. Brown says that, "Climatic conditions are such, on the territory served by the Canadian National, as to make a uniform force in maintenance work impractical. In addition, conditions of industry and agriculture combine against the possibility of distributing equally, with economy, over 12 successive months, the work to be performed." Mr. Newbegin thinks that "It is not practical to maintain a uniform force throughout the year in the territory served by our line and depend on winter rail laying and similar work to keep the force busy. Frost goes into the roadbed from two to three feet, and has been known to penetrate as deep as five feet, making it impractical to do any work that requires the ballast or ground to be disturbed. Furthermore, the amount of snow that must be removed, would increase materially the cost of rail laying during this season."

L. C. Hartley, chief engineer of the Chicago & Eastern Illinois, A. C. McKenzie, engineer maintenance of way, Canadian Pacific, W. H. Penfield, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific, and A. C. Shields, vice-president, Denver & Rio Grande Western, all concur in the opinion that a uniform force throughout the year is impractical for their lines. A. A. Miller, engineer maintenance of way, Missouri Pacific, replies that a uniform force would be practical on about 50 per cent of the mileage of that road, but that no attempt has been made to stabilize the force in this manner. Another officer of a large railway in the Northwest says that, "While I am in thorough accord with the idea of stabilizing employment, in so far as possible, I do not believe that it would be practical or economically possible on a road such as ours, located as it is, in what is classed as northern territory."

J. F. Deimling, chief engineer, Michigan Central, says that, because his road "has for a number of years carried on extensive repairs and renewal of tracks, bridges, buildings and other structures by contract, it has been unnecessary to make radical changes in the regular maintenance forces, so that the reduction to a winter basis requires the laying off of a comparatively small number of men from the normal force."

According to Bernard Blum, chief engineer of the Northern Pacific, a uniform force is maintained throughout the year west of the Cascades. Elsewhere on this road, however, the long winters, heavy snow and extreme cold make it impractical to do maintenance work, other than policing, rail laying, riprap, and the removal of ice and snow, so that, in his opinion, "any attempt to maintain a uniform force throughout the year would result in considerable waste."

While the bridge and building forces and those in the signal and water service departments of the Chicago, Burlington & Quincy are practically uniform throughout the year, and it has been found possible to maintain a uniform track force in Southern Illinois and on the lines in Texas, H. R. Clarke, general inspector of permanent way on this road, is of the opinion that, on the remaining mileage, a uniform track force is neither practical nor economical. For the past two or three years, however, a large part of the rail-laying program has been completed during the winter, but this requires a comparatively small addition to the regular winter force.

Uniform bridge and building forces have been employed on the Great Northern for eight or nine years, and uniform track forces are employed at terminals, but according to J. R. W. Davis, chief engineer, it is impractical to employ uniform forces elsewhere, because of the severe winter conditions in the latitude of his road. Similarly, the bridge and building forces on the Maine Central are substantially the same throughout the year, but the number of men comprising the track forces fluctuates according to the season. C. S. Robinson, chief engineer, says that "little productive work is possible, however, by forces other than those in the signal and bridge and building departments."

The Middle Zone

The Pennsylvania lies largely in the northern zone, but partly in the middle zone. T. J. Skillman, chief engineer, advises that his road "has been unable to maintain a uniform force throughout the year, but advantage has been taken for several years, of the slack season to retain some of the regular force for rail laying, thus relieving the summer forces of this part of the year's program, so that they are able to give more attention to ballasting, tie renewals and other related work."

The Illinois Central passes through all three zones and, therefore, meets all of the conditions encountered separately by the three groups into which the various roads have been classified for the purpose of this discussion. L. H. Bond, engineer maintenance of way, replied that, "On the lines of this system, we have experimented with both methods and have concluded that seasonal forces produce the best results. About half of our road lies in the North and nearly half in the South. There is no question but that a uniform force would work out satisfactorily in the South. In fact, it is almost necessary to work a constant force because of climatic conditions. In the North, during the winter, men will not do good work, and about the only constructive feature of the yearly program that is feasible is the laying of rail, but rail laid in winter can not be taken care of as well as rail laid in the spring or summer."

The Cleveland, Cincinnati, Chicago & St. Louis also lies partly in the northern and partly in the middle zone. While this road does not maintain a uniform force throughout the year, according to Hadley Baldwin, chief engineer, it does undertake as much constructive work as possible, retaining a sufficient number of men to carry on such construction as can be done in the winter and to lay rail in advance of the season's tie and ballast program.

The Pacific Lines of the Southern Pacific also lie in all three zones. W. H. Kirkbride, engineer of maintenance of way, says that "owing to seasonal conditions it is not practical to maintain as large forces on our north and south lines in the winter and spring as in the summer and fall. Between Los

Angeles and El Paso this situation is reversed, owing to the extreme summer temperatures and mild winter conditions in this territory. As a result, the seasonal fluctuation in the size of the forces for the system as a whole is small. More than 90 per cent of our track labor is composed of Mexicans, who prefer to return to their own country during the winter, so that our force is automatically decreased where severe winter conditions prevail without hardship to or loss of good will from the men. At the close of winter we find no difficulty in recruiting our forces with experienced labor."

The Missouri-Kansas-Texas lies partly in the southern and partly in the middle zone. Although of the opinion that a uniform force is very much worthwhile, K. H. Hanger, engineer maintenance of way, voices the opinion of many officers in this zone, when he says he is convinced that the practice is both practical and economical in the southern territory, but is not so certain that it is as well adapted for the middle zone "for the reason that, owing to alternate freezing and thawing, the greatest efficiency cannot well be obtained from labor, so that large programs cannot be carried out with economy."

Delaware & Hudson Maintains a Uniform Force

While the replies already given indicate that the officers in the northern group do not, as a rule, believe that a uniform force is practical because of severe winter conditions, this opinion is not quite unanimous, as is evidenced by the statement of H. S. Clarke, engineer maintenance of way, Delaware & Hudson, that "Uniform maintenance of way forces are practical for our line throughout the year. For several months during the summer, we extend the working day from eight to nine hours, and occasionally, for limited periods, to 10 hours. We make additions to our forces during the summer only when the maintenance forces are required to undertake large construction work. In 1928, with a force of approximately 2,500 men, we had a maximum variation of only 60 men, and this was due principally to sickness and fire patrol."

The advantages of a uniform force are apparent to nearly every officer who discussed the subject, only four saying that they find no disadvantages in a fluctuating force. "There is a decided disadvantage in seasonal reductions," said P. C. Newbegin, "since those employees who are laid off seek other work, so that many of them do not return in the spring, thus making it necessary to break in and train new men every year, with a consequent loss in the efficiency which would be possible if the entire force were retained." C. B. Brown adds that this practice "necessitates rushing the work during the summer with large gangs and inexperienced men." T. J. Skillman says that "the men obtained for seasonal employment are only floaters who are not desired by agencies seeking men for permanent employment." H. R. Clarke observes that the practice of employing seasonal forces "makes it more difficult to recruit local labor. The foreign or floating laborers are neither as efficient nor as interested in their work, and they contribute nothing to the local community in the way of prosperity or citizenship, while the housing and caring for them imposes a considerable burden of time and expense."

Efforts to Extend the Working Season

While the Northern Pacific does not attempt to maintain a uniform force east of the Cascades, the advantages of stabilization are so apparent that this road makes a practice of widening banks late in the fall, placing riprap and laying rail in the winter and doing such other work as the weather permits. Foreign extra gang laborers are allowed to live in camp cars over winter if they desire to do so. "The result of this winter work," according to Bernard Blum, "has assisted us materially in reducing the number of gangs, thereby reducing the investment in tools and outfits, while we have utilized our work equipment to better advantage and have a larger number of experienced men available early in the spring."

An ample force must be retained to form the backbone of a snow or sleet fighting organization when the occasion demands

"The loss of trained men whose initial lack of efficiency has been an expense to the railway," observes K. H. Hanger, "is an economic loss, while the increased personal injuries and lessened production per unit of time, help to increase the cost of seasonal employment." "A definite advantage of uniform forces," says J. E. Willoughby, "is that supervisory officers can plan their work and carry it through in an orderly way with less expense."

It is the experience of E. A. Craft that "the practice of reducing the forces in the fall results in a period of disorganization and small production during the time that the forces are being built up and trained during the early weeks of the following year, while the surplus tools and other equipment must be collected, shipped for storage and reissued in the spring, all of which imposes expenses for which there are no constructive results."

Both W. G. Brown and Hunter McDonald, as a result of their experiences, are convinced that the practice of employing uniform forces tends to raise the morale of the men, assures a regular force of well trained men, reduces the turnover and lessens

the probability of inferior work, particularly in the rush just prior to the reduction period, and avoids the necessity of employing, uneconomically, large gangs to complete the maintenance program in the allotted time.

Another road which recognizes the advantages of uniform forces is the Western Pacific which, in 1927, undertook a six-year program of improvements, involving a total expenditure of more than $18,000,000. During the present season, beginning November 1, this road expects to ballast 47 miles of its main line between Stockton, Cal., and Sacramento, at a cost

Ballasting Gang on the Western Pacific

of approximately $400,000, of which $185,000 will be spent for labor. The application of ballast is being made at this time under the direction of Colonel J. W. Williams, chief engineer, with the purpose of providing employment, during the slack season, of labor which has been used on other work earlier in the year.

Opposed to these views, A. C. Shields sees no particular advantages or disadvantages in employing seasonal forces. A. C. MacKenzie says that so far as the Canadian Pacific is concerned "labor has accommodated itself to seasonal work, seeks employment elsewhere during the winter and returns to the railway every spring." L. C. Hartley believes that the men who are dismissed could not perform efficiently in the winter, so that the year round efficiency is not lowered. W. H. Penfield thinks there is an advantage in reducing the force, "as it conserves the funds until they can be used to best advantage."

Do Uniform Forces Cost More?

The officers in the southern group are a unit in declaring that a uniform force results in decreased maintenance costs, partly because a regular force with a small turn-over has greater efficiency; partly because the program for the year or for a period of years can be planned more advantageously, since there is no confusion or disruption of the forces such as occurs with seasonal employment, and no slighting of the work prior to the reduction period; partly because labor saving equipment can be given a higher factor of use; and partly because the ability to plan in advance results in a greater amount of constructive work being performed by each unit.

The railways with which these officers are connected are all in the South, however, and the conclusions which they have drawn from their experiences in this section cannot be accepted for the northern territory where winter conditions are not at all similar. In order to determine whether the statement that the employment of uniform forces does decrease the cost of maintenance throughout the year is equally true for any section, it becomes necessary, therefore, to produce similar evidence for that section. For this reason, we turn to the Delaware & Hudson, the only northern road that has maintained a uniform force over a period of years, hence the only road in this territory from which reliable data can be obtained, expressions from officers of other roads which do not maintain uniform forces being opinions only.

In his reply to the questionnaire, H. S. Clarke said that "The uniform distribution of work over the various months to best suit our climatic conditions has resulted in decreased maintenance costs." In considering this statement, it should be borne in mind that the winter conditions on the Delaware & Hudson are severe, and that the road is located in a country of heavy snowfall. In a paper which Mr. Clarke read before the Roadmasters' convention in October, he elaborated on this statement by saying that, with an average rate of pay five per cent higher than in 1920, the maintenance pay roll was 19 per cent less in 1928; in the same year, with a rate of pay 15 per cent higher than that of 1922, the total pay roll decreased 19 per cent; while, with a rate of pay 13 per cent higher than that of 1924 there was a decrease of 15 per cent in the total pay roll. In addition, the number of trackmen with less than six months' experience has decreased 65 per cent as compared with 1926, the last year before the forces were put on a uniform basis, although efforts had been directed toward that end since 1924.

What the Executives Think

These opinions and specific data show the trend of thought among engineering officers, and are indicative of the present extent of the practice of employing uniform forces throughout the year, as well as of the results which have been attained by roads upon which the practice is in effect. It will now be interesting to learn the view point of executive officers on the subject.

In his testimony before the senate committee, to which reference has already been made, Daniel Willard, president of the Baltimore & Ohio, said, "We are keeping a more stabilized force at work now than formerly. Whether we have done as much as we ought is another matter. I am sure we have not done as much as we will do. * * * Stabilization can be promoted more by a state of mind than almost anything else I can think of, because what we have done on the Baltimore & Ohio is largely the result of a different state of mind or point of view. Prior to the war, we did not think it wrong to hire 5,000 to 6,000 men in the summer for trackwork, complete it as quickly as possible and lay them off. We had always followed that plan. None of us were impressed with the idea that we were doing any particular injustice to any one." At another place in his testimony he said, "It seems to me that those who manage our large industries, including transportation, should recognize the importance and even necessity of planning their work so as to furnish as steady work as possible to those in their employ. It is an obligation connected with our economic system, and is justifiable on the grounds that it will tend to develop a satisfied and contented body of workmen, which, of itself, will improve efficiency and reduce costs."

O. S. Jackson, general superintendent motive power and machinery, Union Pacific, testifying at the

same hearing, said that his road has "given the problem of stabilizing railway employment a great deal of study and consideration. * * * Seasonal and climatic conditions are largely controlling in the performance of maintenance of way work. Budgets are prepared quarterly every year covering maintenance expenses, and rail and tie renewals * * * and other work which can be anticipated, are spread over the yearly period to the fullest extent, consistent with suitable weather and the heavy fall traffic which we must handle."

At the same hearing, J. T. Loree, vice-president and general manager, Delaware & Hudson, also testified that "The problem of stabilizing employment has been the subject of study by our management for a number of years. In general, it has been the broad subject of employment and, specifically, how on a railroad property of some thousand miles of road, from 10,000 to 15,000 men might be assured of steady work." This study was based on the fact that "The development of the industrial system consequent to the advance in facilities of communication has revolutionized the old economic order, its effect being most pronounced upon the three elements of industrial life—management, capital and labor." And further, upon the realization that, "Other employees, like the individuals of management, desire, and rightfully expect, continuity of employment, good wages and good conditions under which to work."

What of the Future?

Not all of the officers from whom replies were received were willing to make a forecast of the future trend toward more uniform forces. In general, those in the southern group have found the practice so satisfactory that they expect to continue it. The other two groups are somewhat divided. J. R. W. Davis "expects no change in the current practice of employing seasonal labor." F. W. Newbegin takes the same position, but adds, "we might extend the season somewhat, starting earlier and working later in the fall, but this would have little influence on holding men." W. H. Penfield, L. H. Bond, A. C. MacKenzie and A. C. Shields, all see no prospect of more uniform forces. L. C. Hartley qualifies a similar viewpoint by adding, "unless the supply of labor becomes so limited that it will be necessary to give the men permanent employment in order to hold them in service."

On the other hand, many officers recognize a present trend toward stabilization of the maintenance forces and expect the movement to gather momentum as the advantages of the practice are better understood. W. G. Brown thinks that, since "recent past and current experiments have demonstrated its practicability and advantages, converts are being made where adverse opinions had existed formerly and, as favorable results accumulate, railway managements will adopt a program for stable and permanent forces." A. A. Miller and C. B. Brown concur in this view, the latter also believing that the movement will be stimulated by the continued and more general use of labor saving equipment. T. J. Skillman is "looking forward to the possibility of permanent employment of the maintenance forces," and believes that "the tendency will be increased by the greater use of mechanical equipment."

As H. R. Clarke views the situation "the trend toward uniform employment which has been noticeable for several years will continue and become more marked, because of the increasing difficulty in securing temporary labor and also because of its inefficiency; because railway men are beginning to realize the advantages and economies of a uniform force," although he hesitates to believe that a completely uniform force is possible on the Burlington; "because, probably, increased speed and density of traffic will require a larger winter establishment, in order to maintain tracks to the required standard throughout the year; and, finally, because the increased use of machines will create such a demand for skilled labor as to necessitate the retention of trained and experienced men." A. N. Reece and W. P. Wiltsee also concur in these views, as does E. A. Craft, who is of the opinion, however, that, desirable as the practice is, it cannot be fully realized on his road owing to the competition for labor during the harvesting season, although he expects to continue to work to this end.

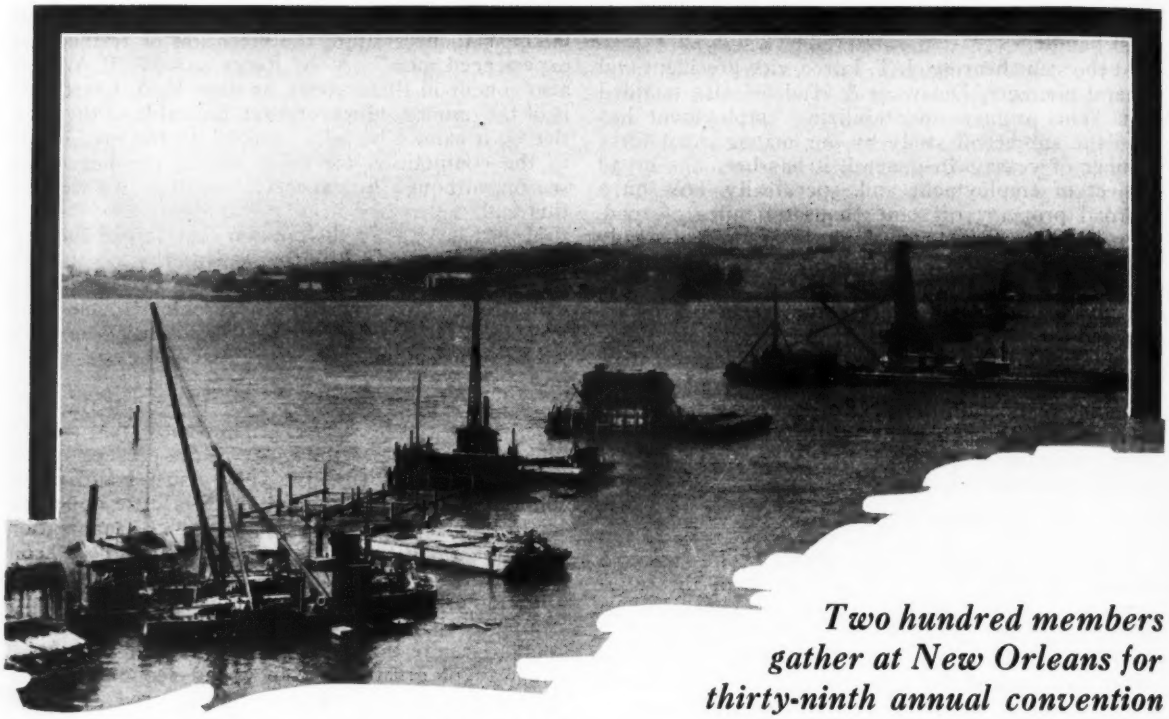
H. S. Clarke is of the opinion that "all of the railways will shortly realize the benefits that result from uniform forces, so that there will be a more decided trend toward working out the problem to meet the special conditions for each road, because the labor saving in maintenance is too great to be ignored by any management."

The foregoing expressions are typical of the present thought on the subject. They show that railway officers are aware of the waste in the present system of seasonal employment. They also recognize that without steady employment there is little opportunity to build up an efficient maintenance organization.

At the same time, the prevailing attitude of conservatism is easy to understand, especially since the adoption of a uniform force will necessitate an almost complete change in the methods on almost every road. Despite this attitude, however, the benefits in the way of greater efficiency and economy are, as Mr. Clarke says, too great to be ignored. Furthermore, the wider application of machines in maintenance work is creating a demand that men who have become skilled, through training and experience in their operation, shall be retained permanently, while the growing difficulty of securing satisfactory seasonal labor and the constant pressure for greater economies in maintenance are also combining to increase the necessity for better planning and execution of the annual maintenance programs and more uniform forces with which to do this. For these reasons, it is to be expected that the trend toward stabilization, which has been apparent for a number of years, will be accelerated until reasonably uniform forces are an accomplished fact.

Scrapped Automobiles Were Used as Rip Rap for this Embankment

Bridge and Building Men Meet in the South



Substructure Work on the Southern Pacific's Suisun Bay Bridge

Two hundred members gather at New Orleans for thirty-ninth annual convention

APPROXIMATELY 200 members of the American Railway Bridge and Building Association, who, together with the members of their families and representatives of the supply manufacturers comprised a party of more than 500 persons, met at the Hotel Roosevelt, New Orleans, La., on October 15-17 for the thirty-ninth annual convention of that organization. More than 300 members of this party left Chicago on Sunday morning on a special train of 15 cars provided by the Illinois Central, which was operated over the recently completed Edgewood cutoff and via Vicksburg, Miss., where a three-hour stop was made for visits to the national park and the new bridge now under construction across the Mississippi river at that point.

The program included the presentation of the reports of eight committees. In addition, a paper, prepared by H. I. Benjamin, assistant engineer of bridges, Southern Pacific Company, was presented describing the present status of the Suisun Bay bridge across the Sacramento river, while I. L. Simmons, bridge engineer of the Chicago, Rock Island & Pacific, described the fire on the Harahan bridge at Memphis, Tenn., and the measures which have been taken to prevent a recurrence.

Tuesday evening was given over to the consideration of southern pine and cypress as bridge and building materials. J. F. Carter, manager trade promotion, Southern Pine Association, emphasized the value of the density rule as a measure of the strength of timber. He deprecated the frequent practice of specifying a high percentage of heart in pine which is to be treated, as an unwarranted expense. He urged the use of grade-marked timber, stating that a sufficient amount of timber is now so marked as to afford a competitive market. He took issue with the American lumber standards, urging that consumers specify grades of the Southern Pine Association.

B. R. Ellis, manager trade promotion of the Southern Cypress Manufacturers' Association, described the long life of this timber and cited numerous instances of its durability in bridge and building work. He spoke at length of the durability of cypress and distinguished between the characteristics of this species of timber grown in various areas. He also discussed pecky cypress at length.

H. R. Safford, executive vice-president of the Missouri Pacific lines, addressed the convention on Wedesday afternoon. In the course of his remarks he emphasized the fact that there has never been a time when the problems arising in bridge and building maintenance were more difficult of solution than at present. "In fact," he said, "the entire transportation problem is changing, the public has never been more friendly than now and bridge and building men have an opportunity to aid in educating the public to a correct understanding of transportation problems. It is necessary that the public appreciate its responsibility for the maintenance of an efficient railway system and it is receptive to information of this character today."

The annual dinner was held on Wednesday evening,

while on Friday the entire party was taken on an excursion of the New Orleans waterfront by steamer, followed by a visit to the plant of the Celotex Company where opportunity was afforded to observe the manufacture of Celotex.

Election of Officers

At the concluding session on Thursday morning, J. S. Huntoon, assistant bridge engineer, Michigan Central, Detroit, Mich., was advanced from first vice-president to president; C. S. Heritage, bridge engineer, Kansas City Southern, Kansas City, Mo., to first vice-president; A. I. Gauthier, supervisor bridges and buildings, Boston & Maine, Concord, N. H., to second vice-president; H. I. Benjamin, assistant engineer bridges, Southern Pacific, San Francisco, Cal., to third vice-president; and W. T. Krausch, engineer buildings, Chicago, Burlington & Quincy, Chicago, was elected fourth vice-president; C. A. Lichty, inspector, Chicago & North Western, Chicago, was re-elected secretary-treasurer; and E. C. Neville, bridge and building master, Canadian National, Toronto, Ont., H. H. Best, supervisor bridges and buildings, Missouri Pacific, Little Rock, Ark., and J. E. King, engineer maintenance of way, Chesapeake & Ohio, Richmond, Va., were elected directors. Louisville, Ky., was selected as the place for the next convention.

The following subjects were selected for consideration by committees during the next year: (1)—Masonry Failures, Their Causes and Remedies; (2)—The Relative Advantages and Costs of Precast Concrete Crib Walls and Monolithic Walls; (3)—Programming Bridge, Building and Water Service Work; (4)—The Use of Power Tools and Equipment in Bridge and Building Work; (5)—Camp Cars and Their Equipment for Bridge and Building Crews; (6)—The Inspection and Maintenance of Water Tanks and Their Appurtenances; (7)—The Modernizing of Station Buildings; and (8) The Maintenance of Turntable and Drawbridge Machinery.

The convention was called to order by Maro Johnson, president of the association and assistant engineer, Illinois Central, promptly at 10 o'clock on Tuesday morning. It was welcomed to New Orleans by R. C. Watkins, vice-president and general manager, Southern Pacific lines, New Orleans, La., who reviewed the development of transportation during the last century and traced the rapidity with which improvements have been made. He urged the association to compile a record of the railway achievements of bridge and building work as an inspiration to future generations.

Prior to reviewing the work of the association during the last year, Mr. Johnson quoted at length from a Handbook of Railroad Construction, written by George L. Vose, in 1857, to show that even at this early date there was a keen appreciation of the technique of bridge construction and maintenance and to recognize the debt that present-day bridge men owe to these old builders of wood and cast iron. Mr. Johnson reported that 54 men were elected to membership in the association during the last year and that this membership now totals 755 in good standing, 93 of whom served actively on committees during the year.

Reducing the Cost of Maintaining Roadway Buildings and Small Stations

F. W. Hillman
Chairman

THE FIRST rule that might be laid down for the economical pursuit of any undertaking is to know positively what is to be done and prepare properly to do it in the most efficient manner. Too often the spirit of "let's go" results in work being started without proper knowledge of what is to be done and without proper preparation and with the result that it is bungled through somehow. Frequently a job is started only to be stopped because certain materials or tools have not arrived or have not been ordered, or because some phase of the situation was not grasped which may change the whole procedure. Starts and stops are expensive.

Much can be said on the question of doing work by contract. While the replies to a questionnaire show that a number of the railroads do contract work, the general opinion seems to be adverse to the practice for maintenance work. Frequently jobs are of such an indeterminate nature that they are hard to let by contract. Such work possibly should be done by railway forces, for advantage can be taken of the breaks and opportunities to lessen cost. Then, too, if unusual difficulties arise, the bugaboo of extra bills is obviated. On the other hand, special equipment may be required which would make contracting advisable. After all has been said, the possibilities of contracting maintenance jobs should not be overlooked, particularly specialized work, such as gutters and down spouts, plumbing, heating and possibly electrical and gas-engine jobs.

Care in Ordering Materials

If, after the nature of the work to be done is thoroughly understood, it is decided to do it with company forces, the first requisite for a good start is to order the material properly. This means that proper descriptions must be given, for one should not expect the purchasing department to guess at what is desired. Frequently, great benefit will accrue if notations are made on the order that certain substitutions may be made. Then, too, sufficient time should be given for delivery, stating as far as possible the desired date of delivery.

Rush orders requiring special purchases cannot be entirely avoided, but can be curtailed if sufficient foresight is used. Co-operation with the stores and purchasing departments is essential and this means that the maintenance department must do its part.

It frequently happens that material must be secured on short notice and in such cases it may be

advisable to permit some responsible maintenance department employee to make local purchases. This practice, however, must be very wisely handled and not abused. Too much freedom with such authority may result in careless ordering of material and uneconomical buying by those not versed in purchasing. Generally, permission can be obtained from the purchasing agent for rush local purchases.

Very careful thought should be given to the use of reclaimed or usable material. A large amount of very good lumber is obtained from condemned cars, which can be used to good advantage in a number of structures. Nearly every job, also, yields some usable lumber or other material which may well be used for patching another job. It is obviously poor economy to use new material in patching or repairing a structure which has only a few years of life and will soon be entirely rebuilt.

Standardization Is an Aid

Standardization is a great aid in the promotion of economy as fewer kinds of supplies or materials need be carried in stock and a better supply of those required can be carried without unduly enlarging the stock account, thereby insuring more prompt delivery. However, too strict adherence to standards may preclude the adoption of some new material or device. Moreover, local conditions must be considered. Some localities require a special type of construction owing to variations in climatic conditions. Hail storms, for instance, require a special type of roofing. Purchasing costs must also be considered. In some localities wood shingles can be secured cheaper than other kinds of roofing, and cast iron pipe cheaper than concrete or corrugated metal pipe, or vice versa.

The standardization of materials also presupposes an attempt at standard design. Too often the designer has no conception of the maintenance problems. Pipes are installed in out-of-the-way places with no thought as to how they can be replaced, repaired or cleaned. Frequently, a few more valves will greatly aid in such work. Too often, too much thought is given to appearance, such as paint color schemes, resulting in the use of too many colors and expensive maintenance painting.

The use of alloy metals is developing quickly. In many instances the usual metals deteriorate very rapidly. A little added first cost for an alloy material may result in greatly increased life and reduced maintenance cost.

Care should be taken to secure the best material available for the nature of the job to be done; that is, consideration should be given to whether the work is temporary or permanent. Cheap materials may be justified for temporary structures but for permanent work cheap material is almost always costly in the end. The length of service secured from different materials is an important element of cost and is obtained only from field observations and records of both service and cost.

The economical conduct of work is of vital importance and this can best be secured through education. Do not throw away advertising matter without looking it over. Much valuable information is obtained in this way. Periodicals also should be read carefully and the descriptions of work done and new devices described should be studied.

A prominent engineer once said that he noticed that the most successful contractor was the one who got on and off of a job in the shortest time possible. The time element of a job is important, but it can sometimes be overstressed. Weather or other conditions may justify abandoning work for a period, rather than continuing it under adverse conditions. This must be decided by the results obtained upon the completion of the work. Frequently the improvement may effect large savings which justify added expense, or it may be that the deferring of one job may delay the starting of another. The finishing of a job should have careful attention.

In the report of "Motor car operation" presented before this association last year the evil of the "let's go" idea was emphasized from a safety standpoint. It is no less important with relation to program and quality of work. There is nothing more exasperating to supervisory officers than to receive advice that some defect was overlooked or that a repair recently made is not functioning properly and must be attended to again. "Haywire" repairs are always costly and uneconomical. Do the job properly.

The question of service and costs presupposes the analysis of the work after it is completed. Too often a job is hastily and inadequately done and promptly forgotten. It is valuable to reflect on what has been done and make a record of its cost in order to see if there is something in the procedure which might be improved and lead to more economical performance of the next similar job.

Labor-Saving Devices

The development of labor-saving devices has been phenomenal in the last few years and their use almost equally so. An important thing to keep in mind when supplied with such equipment is to see that it is used as intensively as possible and that as large earnings as possible are realized from the investment.

Frequently, devices can be used for other purposes than those for which they were planned. A specific case is the paint spraying machine which is very economical for painting and will save its cost quickly. One railroad which uses these machines extensively, conferred with an air tool manufacturer and prepared a list of air tools, such as drills, small saws and steel cleaning tools. As a result, when the compressors are not used for painting, they are frequently employed on small carpenter jobs. The extensive and almost universal use of electricity also affords a wide opportunity for the use of electric tools. It is surprising to note the far reaching effect of the introduction of labor-saving tools into gangs.

Thorough time studies of hand and machine work were recently made by one of the railways, from which it was found that hand sawing cost six to eight times as much as machine sawing, and drilling four to six times as much by hand as by machine.

Programming Is Important

All of the preceding suggestions deal more with the carrying out of jobs such as the railway supervisor of bridges and buildings or the master carpenter has to do all the time, and he is confronted with the problem of getting them all done. This leads to the question of programming work after a schedule has been made. Most railways have some system of periodic inspection on which repairs to be made are listed or scheduled. Estimates are made and submitted to the management, preliminary to securing approval of the work and appropriations therefor. When a schedule is approved the programming of the work authorized is vital. A program is of no value, however, unless it is followed up to see that it is carried out as closely as can be.

There is nothing which makes for efficiency and

consequent economy of effort like high morale and team work, which presupposes confidence. These can be secured only by high-class supervision, which requires personal contact. Too often supervision is considered as requiring only the giving of orders and these by correspondence. That such an idea is absurd need hardly be mentioned. Men want to see the boss, not only to receive orders and instruction, but because they like to know that some officer is interested in them and their work. If men think that no one is interested in them, they cannot be expected to be interested in what they are doing and are likely to contract a careless attitude, which is a positive enemy of economy. Frequent contact with the field forces gives an opportunity for checking up on the work, the discussion of how it should be done, and the exchange of ideas, which are always helpful. It also affords an opportunity to discuss such important subjects as safety, the conservation of materials and co-operation, all three of which, when properly observed, are important factors contributing to economy.

Committee: F. W. Hillman, chairman (C. & N. W.), P. Aagaard, vice-chairman (I. C.), E. H. Brown (N. P.), G. M. Haley (U. P.), W. J. Lacy (M. P.), W. J. T. Manning (D. & H.), C. J. McCarthy (C. M. St. P. & P.), P. N. Nelson (S. P.), E. C. Neville (C. N. R.), and Kemper Peabody (N. Y. C.).

Discussion

The discussion of this report centered largely around that portion relating to the handling of work by contract. R. D. Ransom (C. & N. W.) referred to the difficulty that arises on a road where a variety of standards results from the acquisition of numerous lines, and stated that where such a condition exists, it is frequently cheaper to contract small repair work to local men who can pick up needed material, rather than to attempt to purchase it through the regular channels.

A. I. Gauthier (B. & M.) stated that while it is not the practice of his road to contract any bridge work, it does contract many small building repair jobs, such as leaks in water pipes or in roofs, the replacement of broken platform planks or window panes or the repair of toilets. For this purpose each division maintains an up-to-date list of available artisans in every town on its territory. When repairs of this character are needed, the agents take them up direct with the local supervisors of buildings. In reporting such necessities, the agents are encouraged to suggest an artisan who can do the needed work. In such work contractors usually provide the material, as well as the labor. Frequently agents themselves make needed repairs when provided with materials. Larger jobs requiring several days work, are not usually emergency tasks and there is usually sufficient time to permit bids to be taken on them. To secure prompt attention to locomotive water supply and grade crossing repair work, operators are instructed to take such needs up direct with the district repair men, copies of such advice going to the division supervisor of bridges and buildings and the division superintendent.

C. R. Knowles (I. C.) stated that economical maintenance requires a carefully considered program, made after a detailed inspection by the supervisor or foreman. After the program has been approved, money for its execution should be allowed from month to month and the supervisor should be notified in advance of his allotment so that he can have the necessary material on hand to do the work as authorized.

Maro Johnson
President

President Johnson has had more than 30 years' experience in railway engineering work, most of it relating directly to bridge construction and all of it in the service of one property, the Illinois Central. After graduating from the University of Iowa in 1898, he entered the employ of the Illinois Central as a masonry inspector and subsequently held various positions until 1905, when he was transferred to the Indianapolis Southern (now a part of the Illinois Central) as resident engineer. Returning to the parent company two years later, he was engaged in track elevation work at Chicago involving a large amount of bridge work, and has since been concerned largely with bridge construction. President Johnson joined the association in 1916, and after evincing interest in its affairs through participation in the work of several committees, he was elected a member of the executive committee in 1921 and a fourth vice-president in 1924, since which time he was advanced through the chairs until he was made president last year.

The Selection and Training of Men for the Position of Foremen

C. J. Geyer, Chairman

A MAJORITY of the railroads have contracts or agreements with their employees in the maintenance of way department. Practically all such agreements provide that seniority shall be given consideration in the promotion of men in the foremen classes. Any plan for the selection of foremen must be developed in the light of these seniority clauses in existing agreements and must be absolutely fair to all classes, in order to be sound. It is the thought of the committee that the plan of selecting foremen, outlined in this report, can be made to fit such seniority agreements by slight modifications of the plan for a selection agreement without affecting the rights of any class.

Source of Supply

For many reasons well known to all, the rank and file of the various bridge and building gangs is the best source from which to draw foremen. This being true, it must follow that any plan for developing foremen, or higher officers, must start with the careful selection of men when they are first taken into the service. It is recommended that every man, before being employed in a bridge and building gang, be selected by the gang foreman and the supervisor, acting as a committee, and that so far as practicable the men selected should all measure up to the qualifications included in a fixed scheme adopted by the management.

One of the first things to consider when a new man is being selected for employment is his age. The minimum age must be within the requirements of child labor regulations and the maximum age must be high enough to permit of a wide selection of skilled men, but, at the same time, must not be so high that expectancy is of a comparatively short duration and pension rules and rights are materially affected. It is felt that a minimum age of 18 years and a maximum age of 45 years will meet all requirements.

Health

Probably the most important single item to consider in the selection of men for any position is physical condition. The supervisor and foreman should satisfy themselves that the prospective employee is in reasonably good health and physical condition.

On our modern railroads, it is essential that the officers have a good education and it is very desirable that as large a percentage as possible of the rank and file employees be well educated. The supervisor and foreman should pick some young college men who are ambitious and willing to start at the bottom, some young men who have only a common school education but who show promise of better things by their willingness to study at home, and some older men who have come through the hard school of experience. Such a gang will be well balanced and with proper training there will always be men available for the higher positions.

Character

A man having the educational qualifications herein outlined is very apt to be a man of good character. It is unnecessary to outline the many things that go to make good character—the requirements are too well known and the committee's experience is that a very large majority of the men engaged in bridge and building work on the railroads are men of good character. The supervisor and foreman should satisfy themselves that the prospective employee is such a man.

When the system for the careful selection of new employees above outlined has been in effect a reasonable length of time, there will be many potential foremen in each gang and some of these men will be capable of advancement to positions much higher than foremen. It is then time to select from among these men the ones thought to be the most promising for the position of foremen. The supervisor and foreman should consult with the division engineer, or corresponding officer in charge of bridge and building work, and these three men should study the qualifications and record of each man on the gang and pick two or three on each gang who are thought to be the most capable of filling higher positions.

When some men from all the gangs have been so selected, a list of these men should be prepared and kept by the division engineer and supervisor. The list should show the complete record of each man and should be kept up to date.

Training

A list and record of the prospective foremen having been prepared, the training period should be started. Throughout this period, the local officers from gang foremen up, should watch the performance and bearing of each man on the selective list and revise the list from time to time by dropping those that are not measuring up to the fixed standard, and adding others that at first did not show the necessary qualifications.

When local officers visit the various gangs, they should endeavor to talk with the prospective foreman without making it too apparent to the man and to other members of the gang that he is being singled out from his fellow-workmen. During such talks, the officer will get a good idea of the man's progress and a general knowledge of his work.

As each of the selected men becomes proficient in his duties he should be advanced to the higher grades in the gang, as such positions are open, until he has reached the top class. The foreman should then use him to help with reports and the planning of work. Whenever there are odd jobs to be done, requiring a few men to be detached from the gang, he should be put in charge of these men and so acquire confidence in himself and the ability to handle men. When he has advanced to this stage, he has become a gang

leader and should be so recognized by the other men. He may not be the most skilled workman but he has a general knowledge of all requirements, knows how good work is done and how much work each man should accomplish.

A bridge and building foreman is alone on the job for a large part of the time. He must, therefore, have initiative, be dependable and capable of assuming responsibility without the advantage of advice from a higher officer. If the prospective foreman has these qualities, they will be developed during his training as a gang leader. If such qualities are not developed, his name should be dropped from the selective list.

Inspector and Relief Foreman

After becoming a gang leader, the prospect is qualified as a bridge and building inspector and as a relief foreman for short periods. During this part of his training it is well to have him accompany the supervisor on the regular inspection trips over the division. He will be able to assist the supervisor in planning the work and will gain a broad knowledge on such trips of the duties of an officer.

These trips will give the supervisor an opportunity to instruct the employee in all the duties of a foreman. He should examine him on the rules, tell him of the safety requirements and instruct him in the care of tools, the conservation of material and the planning of work. The supervisor should then be able to satisfy himself whether the employee is ready to handle a position as foreman and if the officers have faithfully performed their duty, he should be ready for promotion after such a course of instruction and training.

Time of Training

The committee has spent much thought on the length of time required in each stage of the training period and feels that no definite time can be recommended because conditions on each road are different, the ability of the men to take advancement is not the same and vacancies in the higher ranks will vary with the labor turnover and business requirements.

Committee: C. J. Geyer, chairman (C. & O.), G. S. Crites, vice-chairman (B. & O.), C. E. Brightwell (C. & O.), V. S. Brokaw (C. M. St. P. & P.), F. P. Farrell (M. P.), W. C. Harman (S. P.), D. T. Rintoul (S. P.), W. A. Stewart (C. Vt.), W. G. Swartz (C. N. R.), S. C. Tanner (B. & O.), C. D. Turley (I. C.), J. J. Wishart (N. Y. N. H. & H.), and J. P. Wood (P. M.).

Discussion

It was evident from the discussion of this report that those present were keenly appreciative of the importance of the foreman's place in the maintenance of way organization. A. I. Gauthier (B. & M.) emphasized the fact that more is required of a foreman today than ever before. He is the man who actually spends the company's money. More clerical work is

J. S. Huntoon
First Vice-President

A. I. Gauthier
Third Vice-President

Bridge and Building Association

Officers 1928-1929

MARO JOHNSON, President, Assistant Engineer, I. C., Chicago.

J. S. HUNTOON, First Vice-President, Assistant Bridge Engineer, M. C., Detroit, Mich.

C. S. HERITAGE, Second Vice-President, Bridge Engineer, K. C. S., Kansas City, Mo.

A. I. GAUTHIER, Third Vice-President, Supervisor Bridges and Buildings, B. & M., Concord, N. H.

H. I. BENJAMIN, Fourth Vice-President, Assistant Engineer Bridges, S. P., San Francisco, Cal.

C. A. LICHTY, Secretary-Treasurer, General Inspector, C. & N. W., Chicago.

F. E. WEISE, Assistant Secretary, Chief Clerk, Engineering Department, C. M. St. P. & P., Chicago.

Executive Committee

F. C. BALUSS, Past President.

(Terms Expire October, 1930)

G. A. RODMAN, General Supervisor Bridges and Buildings, N. Y., N. H. & H., New Haven, Conn.

W. A. BATEY, System Bridge Inspector, U. P., Omaha, Neb.

F. W. HILLMAN, Assistant Engineer Maintenance, C. & N. W., Chicago.

(Terms Expire October, 1929)

R. C. HENDERSON, Master Carpenter, B. & O., Dayton, Ohio.

T. H. STRATE, Engineer Track Elevation, C. M. St. P. & P., Chicago.

J. S. EKEY, Supervisor Structures, B. & L. E., Greenville, Pa.

C. S. Heritage
Second Vice-President

H. I. Benjamin
Fourth Vice-President

required of him. He must be able to direct men. He must be able to use materials intelligently and to conserve them. He must be able to read plans readily. He must also do his work safely.

J. P. Wood (P. M.) urged that foremen be trained to supervise and direct their men so that the work would be done properly rather than taking an active part in the work themselves. T. Turnbull (Ann Arbor) stated that he turns all applications for positions in gangs over to his foremen and places on them the responsibility for the hiring of their men. Likewise when a foreman is needed he asks his foremen for recommendations from their gangs.

F. W. Hillman (C. & N. W.) emphasized the importance of supervisors talking with the foremen at frequent intervals regarding their work and discussing their problems with them. He urged that the foremen be encouraged to develop initiative.

P. N. Nelson (S. P.) stated that it is the plan on his road to employ an assistant foreman with every gang of 15 or more men and a leading man with every gang of 10 or more men, thereby providing a group from which foremen can be selected as needed. E. C. Neville (C. N. R.) stated that he has found that the degree of interest shown by his men in the reading of *Railway Engineering and Maintenance* affords an indication of their interest in their work and their availability for promotion.

Protection of Underground Pipe Lines from Deterioration

W. E. Pierce
Chairman

ALTHOUGH the subject of protecting underground and overhead pipe lines against corrosion has engaged the attention of water-service men for many years, it is estimated that the average service life of pipe lines in railway service throughout the country is less than 70 per cent of their potential life, if full protection were provided against corrosion. It is evident, therefore, that either the methods that are being used to protect these lines are not fully effective or that they are not being used as extensively as they should be. Since the present installations of wrought iron and steel pipe lines that are being maintained by the engineering department exceed 110,000,000 lin. ft., in addition to more than 57,000,000 lin. ft. of cast iron pipe, the protection of these lines against corrosion is of major importance.

Oxidation, the ordinary form of corrosion in iron, can take place only in the presence of moisture. The same is true of the corrosion which is caused by the presence of gases from locomotives and power houses. If we are able to keep moisture from the outer surface of the pipe, we can entirely eliminate corrosion. This frequently requires considerable investigation and study, even where the conditions seem to be simple and the facts are supposed to be known. The results that are obtained will nearly always depend on such study, so that considerable money may be saved and disappointment avoided if it is made.

Pipe Must Be in Good Condition

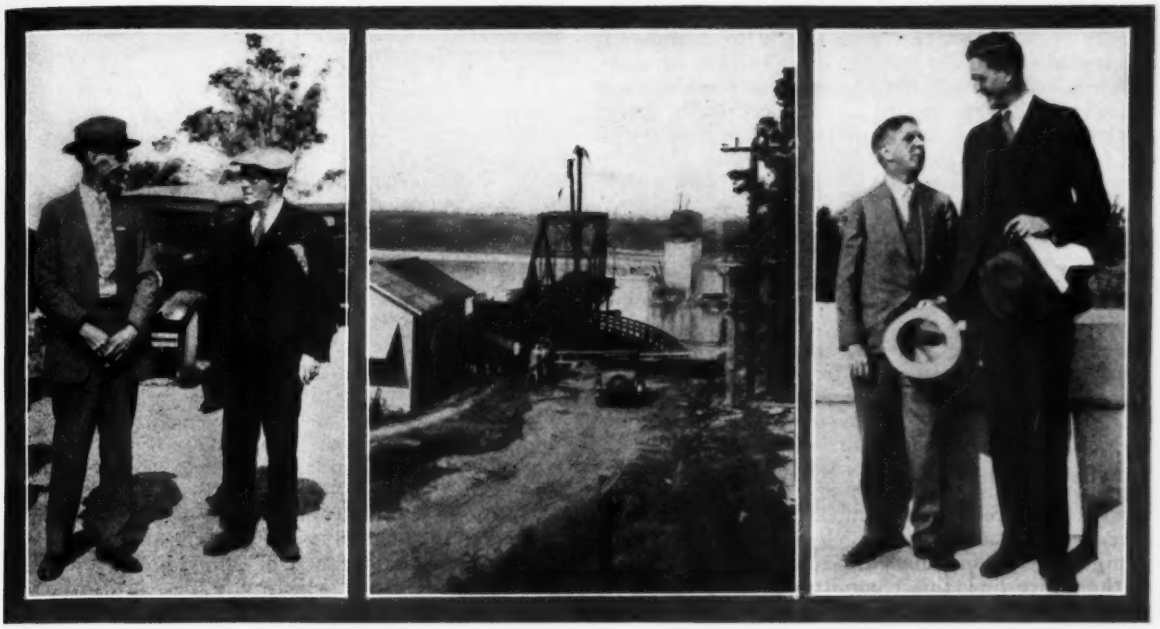
In making this study, it should be borne in mind that the success of any method which may be selected will depend in large measure upon the condition of the pipe at the time the protection is applied. Among other things, corrosion should not have progressed to the point where the safety of the pipe line or its usefulness are already impaired. Before the protection is applied, the surface must be free from scale, dust, dirt, oil and other foreign matter. This can usually be accomplished by means of a scaling hammer and a stiff wire brush. The important point is that the surface must be clean when the protection is applied. If this is in the form of a coating, be sure that the material is highly resistant to or does not react unfavorably with the substances which attack the iron and steel.

In making a selection of protective materials it is also highly desirable to choose one which can be applied under field conditions. It is seldom or never possible to apply the protective material in the shop or before the pipe is assembled. Even if it were, there still remain the joints or welds which must be taken care of after the pipe has been assembled in the field. For this reason a material which is not adapted to field application is practically useless, irrespective of any merits it may possess otherwise as a protection against corrosion.

Protective materials which are entirely suitable for certain conditions may be wholly unsuited for others. When the pipe line must undergo wide fluctuations in temperature, elasticity of the protective material is of prime importance. If the pipe is to receive frequent handling or comes in contact with equipment or other materials, the protective material must be able to resist abrasion. If it is to protect a pipe line laid in wet ground, it must be completely waterproof, and must also be able to resist the solvent action of the water. In every application it must adhere to the pipe under all conditions and must not blister or run at high temperatures or crack or peel at low temperatures or when it dries. It should not deteriorate with age, and it must be completely inert to the metal it is to protect.

Many Paints Available

Numerous materials in the form of paints are on the market, which are satisfactory when used above ground, but which do not give permanent protection to underground lines. Red lead is an example of this type. In many applications above ground it gives almost complete protection when used with an outer coat of suitable paint. Used on underground lines, it immediately absorbs water and loses its adhesive qualities, with the result that it soon loosens from the pipe and fails to afford any protection.



Two Michiganders, T. Turnbull of the Ann Arbor, and John Wood of the Pere Marquette

The New Bridge at Vicksburg Was of Interest to Many

The Long and Short of it—Tom Lehon and "Mac" Rutherford

Tar paper and tar or asphalt-saturated felt and prepared roofings have been used frequently to cover pipe lines, under the mistaken impression that they afford protection. Nothing could be more erroneous. These materials cannot be made to adhere to the pipe and, consequently, do not have any protective value. Used in combination with other materials and methods, they may, however, have a high value.

Protective compounds made from an asphalt base have been used with excellent results in many cases while in others they have failed to give satisfaction. In general, they must be protected from abrasion, this protection being best afforded by covering the treated pipe with a good quality of heavy roofing felt. In some instances, the presence of certain salts in the soil causes sufficient physical change in the coating to render it useless, since the bond becomes broken, allowing moisture to enter and start corrosion.

A Non-Hardening Compound

One type of protective coating, which is non-hardening, has given excellent results under a wide variety of conditions when applied to pipes other than those that serve in hot water or steam lines. This type can be applied, probably, more easily under field conditions than any other that is commonly used. It is applied directly to the pipe after it is laid in the trench. There is a tendency, however, for the coating to shift to the bottom of the pipe, particularly in warm weather, so that the pipe should be inspected and touched up wherever necessary, immediately before the trench is backfilled.

This type of protective coating can be used with a canvas wrapper when the pipe must be handled frequently; when the pipe is laid in cinders, broken stone or other rough, sharp materials; where there may be movement of the pipe in the soil; or where other forms of abrasion are likely to occur. Where non-hardening coatings are applied, the soil seldom adheres to the pipe and, in almost any clay, if the seal is broken, the coating will close before corrosion has had a chance to get started. The cost of these coatings, applied, is about the same as for paints. Some of these materials have the added advantage that they not only prevent rust but arrest the further progress of corrosion which is already under way.

A plan which has been tried and which, according to reports, may be quite successful in preventing corrosion, is that of embedding the pipe line in concrete. The cost is prohibitive under the conditions usually met in railway service, and so much care is required to insure that the encasement is made properly, that this method cannot be recommended except where the conditions are unusual and the importance of the line will warrant the expense. In any case this construction cannot be used in alkali or highly acid soils.

Clay Tile Conduit

A much cheaper and better form of construction is the clay tile conduit. At least two manufacturers are producing tile conduits which are giving satisfaction under a wide range of conditions. While they are designed primarily for the protection of the pipe insulation which is used on hot water and steam lines, they can also be used as a housing for cold water and air lines.

An advantage that they possess is the provision that is made for drainage. If they are laid to a proper grade, the water in the surrounding soil is collected in drains, which are made an integral part of the conduit, and which are placed below the position of the pipe in the conduit, and led to an outlet, so that this water is kept from contact with the pipe.

Any pipe that is subject to considerable fluctuations in temperature will expand and contract. Such a pipe line should be laid in a conduit and, if loss of heat is a matter of importance, it should be thoroughly insulated as well as protected against corrosion. Ample provision should be made for expansion and contraction in such a way that the protective film will not be broken by this movement of the pipe. As has been pointed out, one of the prin-

cipal features of a good conduit is drainage, and it is largely upon the success with which the drainage is accomplished that the success of the conduit depends.

While clay tile conduit is satisfactory under most conditions, it can not be used successfully under tracks. Here the material should be cast iron, which not only provides ample strength to resist the pressure and the strains caused by vibrations, but is highly resistant to corrosion.

Water Treatment Sludge Sometimes Used

A form of protection which has a limited application is the encasement of the pipe in sludge from a lime-and-soda ash water treatment plant. When this method is followed, it is important that a sufficient depth of sludge be placed in the bottom of the trench to insure that the pipe will be completely surrounded.

Under the most favorable conditions, the protection of underground pipe lines is difficult and the cost is frequently high. From the very nature of the construction it is not possible to know currently what results are being obtained. Since this is true of every underground pipe which has not been placed in pipe galleries of sufficient size to permit inspection of the entire line, this committee recommends that, whenever it is possible to do so, pipe lines be located above ground. While the cost of installation may be high in the case of some pipe lines which can be laid underground without the necessity of insulation, the longer life and better maintenance will usually offset this additional cost.

Committee: W. E. Pierce, chairman (D. & H.), O. C. Anderson, vice-chairman (S. P.), Geo. E. Boyd (*Railway Engineering and Maintenance*), J. H. Bugg (C. N. R.), R. T. Burns (C. & N. W.), L. A. Cowsert (B. & O.), Wm. Gilbert (C. & O.), M. M. Munson (M. P.), T. E. O'Brien (D. & H.), L. C. Prunty (U. P.), and W. L. Wallace (P. M.).

Discussion

W. T. Krausch (C. B. & Q.) stated that it is his practice, as far as possible, to place steam lines overhead, but that when it is necessary to place them underground, he puts them in salt-glazed tile. When laying water lines underground, particularly of cast iron, it is his aim to place sand at the bottom of the trench in bad soils and to lay the pipes in this sand, although he has experienced little difficulty with the deterioration of cast iron pipes. He recently dug up and relaid a cast iron pipe line after 38 years' service. C. D. Turley (I. C.) called attention to the increased difficulty of jacking cast iron pipe under tracks as a partial offset to its advantage from the standpoint of durability. F. H. Masters (E. J. & E.) urged that tracks be so laid that joints be kept away from points immediately above pipes. C. R. Knowles (I. C.) emphasized the importance of studying the corrosive character of soils in which pipe lines are to be laid and the selection of pipes to meet the conditions to be encountered. "Where the soil is known to be corrosive," he said, "such as in cinders, pipes should be amply protected. Six inches of good clay around a cast iron pipe will offer adequate protection in almost any soil."

Wearing Surfaces for Passenger and Freight Platforms

William Cardwell
Chairman

AT THE minor freight stations and the combination passenger and freight stations, all that is necessary is to provide a fairly even surface over which a relatively small amount of freight or baggage may be moved each day without a prohibitive expenditure of energy on the part of a man who, generally, may take his time. Here practically the only destructive agency which need be considered is the weather, and in the case of platforms built up to the level of the car floor, ventilation will generally be good. Under these conditions timber will give a service life sufficiently long to be economical and at the same time furnish a surface suitable for the requirements. Additional life can be secured by treating the timber used and greater or less resistance to wear may be secured by the choice of timber, with a corresponding variation in cost.

Passenger platforms at the less important stations similarly have simple requirements to fulfill. In such installations platforms of screenings seem to serve the purpose in most sections of the country and, if well kept and provided with timber curbs, they are of fairly good appearance. The objections to screenings are that, when installed under canopies, they have a tendency to dry out and blow away, or at least to be dusty, while in winter in the colder parts of the country, they may be difficult to clear of ice and snow, and in thawing weather the may be mushy under foot. It is also the practice in some cases to install a stretch of brick or concrete platform immediately in front of the station building and flank it on either end with extension platforms of screenings of sufficient length to accommodate long trains.

The chief advantage of a platform of stone screenings is its cheapness, and, all things considered, in the present condition of local passenger business, it may often be found that the cheapest material that can be installed is the only one that can be justified.

Important Freight Platforms

Platforms for the handling of freight at receiving and delivery stations in the large centers of population and the l. c. l. transfer stations, which are increasing in number and size constantly, require surfacing materials capable of resisting the wear of a continuous stream of trucks. The tendency is to use automotive tractors to draw long trains of trailers from car to car and from car to warehouse or motor trucks.

Where trucking of freight is the only use to which a platform is to be put, the most essential quality is resistance to wear under the conditions of weather

The Pullman Conductors Were Popular

The Party Enjoyed the Trip over the Vicksburg Battlefield

Just a Touch of Local Color

and exposure existing at the particular locality. After this come in order, the tractive effort necessary to move loads and the cost, both initial and per year, as determined by the character and degree of maintenance required. Another point which is of particular interest is the possibility of carrying out the repairs which may be necessary without serious interruption of traffic.

The materials suitable for this type of platform are named below in the order of their importance as indicated by the extent of their use by the various railroads of the United States and Canada.

1. Concrete, with or without hardener.
2. Asphalt, either preformed or poured in place.
3. Wood, in the form of either blocks or planks.

Concrete Wearing Surfaces

Many floors have been constructed of portland cement concrete either with or without the addition of a metallic or chemical hardener and many railroads report good results from this material. The proper provision in the design for expansion and contraction due to temperature variations and proper drainage of the sub-floor should make this type of floor independent of weather conditions and therefore attention should be concentrated on getting a surface with the highest possible resistance to wear.

A concrete floor offers less resistance to the passing of wheels than any other so long as it remains smooth, by reason of its hardness. This may at first suggest a condition conducive to fatigue on the part of those having to walk over it. However, it seems that this is not as bad as has been assumed in the past, and furthermore, the increase in the use of tractors is reducing the amount of walking that need be done.

The cost of a concrete wearing surface is probably less than that for any other of equal permanence. In many cases, the only increase over the cost of the sub-floor is that of the troweling. If the necessity for repairs should arise, however, the cost per year, as well as the annoyance of continued interruption of traffic, may very well be increased considerably, and since very much depends upon the quality of workmanship secured in the placing of the floor, and its final quality is not known until too late to change, this factor is very important. Owing to the difficulty of securing a satisfactory bond between old and new surfaces, repairs are hard to make and of doubtful permanence. These factors are probably responsible for the fact that in spite of the lower cost of concrete wearing surfaces, many roads are using other types of construction, or are using some of the various types of hardeners which are now available.

These hardeners are available in three common forms, metallic, chemical for integral application, and chemical for surface application.

It is the conclusion of the committee, however, that for freight platforms metallic hardeners are beneficial but that no others are of sufficient efficiency to justify their use.

Where a concrete floor troweled smooth would be too sleek to provide sufficient adhesion for traction, in cases where tractors are used, it may be necessary to introduce an abrasive into the top finish.

Asphalt

The use of asphalt products for floors seems to have become quite general and they have some advantages which make their use in freight platforms advisable. They are divided into two general classifications, preformed and poured in place.

The poured-in-place form, known generally as mastic is delivered to the job in the form of blocks melted down with a flux, and spread upon the sub-floor. Having no structural strength, it requires a sub-floor capable of taking the stresses induced by whatever loads are imposed upon them. The materials are composed of either a mineral aggregate, which should be carefully graded and mixed with a manufactured asphalt binder, or a natural rock asphalt. There does not seem to be any distinguishable difference, so far as resistance to wear is concerned, between the two types.

The term asphalt mastic generally implies a material which is applied hot and rolled or otherwise smoothed out into a flat sheet about 1½ or 2 in. thick. This form has had a very extensive use for many years and has given very good service. The manner in which it fails, when it does fail, by rolling

up under traffic, indicates a feature which must be very carefully provided against. This is the possibility that the consistency may be such that the surface will be too soft. In addition to the possibility of final failure from this cause, this condition will be a constant source of irritation owing to the increased resistance to rolling friction that it imposes to trucking.

Is Used Extensively

There are many trucking floors of asphalt mastic in use in various parts of the country, some of which have given excellent service for many years. Most of these are in freight houses, but, with proper provision in the sub-floor for expansion, it would seem that the material would give satisfactory service where exposed to the weather, since it is impervious to moisture and sufficiently resilient in itself to expand and contract under the influence of temperature changes.

There are many forms of unit asphalt paving on the market today and they may all be placed in two classes, both as determined by the shape and by material characteristics. One is in the form of bricks, made of either a natural rock asphalt or an asphalt-impregnated mineral aggregate. The other is in the form of planks generally made of a felt or other fibrous base impregnated with asphalt.

It will be noted that these preformed materials may be used over a wood substructure if a way is found of holding them in place, since movement of the sub-floor does not affect the individual units as it would a continuous sheet. There have been instances of the use of these units as wearing surfaces on the decks of timber bridges which appear to be satisfactory.

The maintenance of asphalt wearing surfaces whether poured in place or preformed, is relatively simple. With the poured-in-place floor, it is only necessary to heat a small quantity of the material and tamp and smooth it in place. The preformed units may generally be removed when necessary without damage and then hammered back into place. The exception to this simple procedure is when a preformed unit is used which has a shiplap or other interlocking form, in which case some care will be required to remove the planks and re-insert them or new ones, if indeed it is possible.

The nature of the materials used in these products is such that the units will weld together under traffic and make a wearing surface which is impervious to water over its entire area. The surface is not slippery and provides sufficient adhesion for traction.

Wood Floors

Wood was the material with which the bridge and building forces first became familiar and it still remains one of the most useful materials in the construction and maintenance field. In providing a wearing surface for freight platforms, it is used in two major ways, in the form of planks with the grain parallel to the surface and in blocks with the grain perpendicular to the surface. A variation of the former is what is known as edge grain where the boards are sawed in such a manner as to bring the annular rings perpendicular to the surface when laid.

The most common forms of lumber for use as a wearing surface on platforms where the wear is severe are maple boards and fir or yellow pine blocks. Some roads report the use of edge grain fir with good results.

A wearing surface of maple boards should be laid crosswise to the direction of traffic and the boards should be square edged and not tongue-and-groove. The sub-floor, if of timber as in the case of some of the large transfer houses, should be of ample strength of itself to support the applied loads without any appreciable deflection, in order that there be no weaving in the wearing surface. Where tongue-and-groove lumber is used as a top floor, the tongues and the splines form a weak point, tending to split off and to crush. Careful inspection should be maintained during construction to insure that the boards are sufficiently well nailed. It is also recommended that where timber sub-floor planks are used, they be treated with some form of preservative.

The open nature of a floor of wood boards prompts the thought that they should not be chosen for locations exposed to the weather. There are too many places for moisture to collect and remain long enough to promote rot.

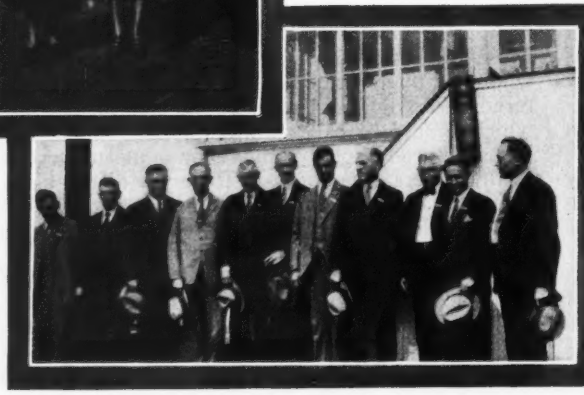
Wood Blocks

Wood blocks are made in two principal forms, those which come loose and are laid in the floor much

At the left—Mr. & Mrs. C. W. Wright of the Long Island and Mrs. Lehrman (In the center)

Below — The Canadian National was, as usual, well represented,—11 of its 13 representatives

At the right—The association believes in advertising



as bricks are laid, and those which come already fastened to boards in long lengths and are nailed and splined together as they are laid upon the floor. These two forms present identical surfaces when finished, that of the end of the grain. They are made of creosoted fir, yellow pine and redwood. They form a wearing surface that is satisfactory for trucking, not hard on the feet and not slippery. Where required by the nature of the commodities to be handled, the blocks can be had treated with an odorless stain which will not contaminate such commodities as sugar, flour, etc. A form of block is available which provides space for expansion where it is necessary and this is a very important feature, since it may be required to prevent buckling.

In laying these wood block floors over a concrete sub-floor, the concrete should be brought up to a level, even surface with a wood float, in order that there shall be no bumps or hollows which might cause the blocks to rock or split. The blocks are then laid over a coating of cut-back asphalt, after which a coat of asphalt joint filler is mopped over and the surface dressed by means of a motor-driven wire brush.

The maintenance of these two types of floor should not present any insurmountable difficulties to bridge and building forces. Of the two types, the individual wood blocks should be the easier to repair or renew. Here again the committee feels that the use of wood should be confined to places where it will be protected from rain and snow, owing to the danger of swelling and buckling.

For the exterior platforms at the larger stations brick seems to give the most satisfaction. It has a very good appearance, wears well, is easily repaired when necessary, has a good salvage value when changes require removal and stands the shocks of baggage dropped on it without material damage. For the platforms in large passenger terminals where a satisfactory foundation can be provided, asphalt mastic has given very good service. In such installations an additional factor enters into consideration. This is the absence of noise. In the larger terminals sleeping cars are frequently parked while occupied during the night. The noise of trucks, the handling of sewage-soil cans, etc., must be reduced to a minimum, and asphalt mastic is very well fitted to accomplish this, since it has a smooth, resilient surface and trucks roll quietly over it without excessive banging of the contents.

Portland cement concrete makes a very good platform, as is evidenced by its use in one of the newest and largest terminals of the country, but it is not so quiet as asphalt mastic and has one feature that must be guarded against where it is used outside, the glare from reflected sunlight, which may become so intense as to be painful and perhaps even dangerous. This can be obviated at the time the concrete is poured by introducing a coloring matter into the top course and finishing with a wood float instead of a steel trowel. In the case of platforms already built the glare can be reduced by the application of stains. These, of course, are not permanent but can be renewed from time to time in connection with other work at the station.

Committee: William Cardwell, chairman (Wash. Term.), F. M. Lehrman, vice-chairman (C. & N. W.), E. E. Candee (N. Y. N. H. & H.), John Harden (M. C.), R. C. Henderson (B. & O.), J. E. King (C. & O.), Sam Lincoln (G. C. & S. F.), E. J. Rykenboer (N. Y. C.), F. H. Soothill (I. C.), H. C. Swartz (C. N. R.), and C. W. Wright (L. I.).

Discussion

The patching of concrete floors was actively discussed. One member reported success in patching concrete with a cold mastic which can be rolled out to a feather edge. A. C. Irwin (Portland Cement Assoc.) stated that when patching concrete with concrete, the old surface must be thoroughly wet and the new material must be given a chance to bond with the old by being thrown or rammed against it. W. T. Krausch (C. B. & Q.) stated that he has used a great deal of concrete in shop and storehouse driveways in recent years. He described a storehouse that he built at Aurora, Ill., four years ago with floors and ramps of reinforced concrete, the runways on the latter being paved with asphalt blocks to permit their renewal in case of wear. On the concrete runways a metal hardener was introduced in the top course which has stood up better than straight concrete. He reported success with the use of creosoted maple for outside platform service and untreated maple inside freight houses, this timber being easy to truck on. He has experienced no damage to freight from the creosote.

At the right—At the U. S. Grant monument

Below—A few minutes air while changing engines

At the left—Twenty-two of the 25 C. & N. W. men

Relative Economy of Concrete Mixes and Practical Tests for Concrete Aggregate

F. H. Cramer
Chairman

THE STUDY of the relative economy of concrete mixes leads into two distinct fields. The first involves the kind of a mix that will prove most economical. How stiff should a concrete be to be handled with the maximum economy? Must it be harsh or smooth, and how much?

Increasing the proportion of coarse material up to a certain point reduces the proportion of cement. Beyond this point, the lack of mortar produces a harsh, stubbon concrete that is unduly expensive to place and finish. Increasing the amounts of both aggregates also increases the yield but if carried too far this results in a stiff concrete that is equally difficult to mix and place. On the other hand, a very fluid mixture needs the least labor in handling but the cement content is so high that it is needlessly costly, except for some special purposes. It is futile to save in material costs, only to cause a greater increase in cost elsewhere. The reverse is also true. There must be some best condition for each particular case.

On small or on large and important structures it pays from an economic standpoint to make very thorough studies of all of the available materials and their relative properties. The proper workability to use on a particular job is not open to exact analysis and rests wholly on the judgment of the one who decides. There are many published schedules of best workabilities which the average bridge and building man will be safe in accepting as his guide, tempering them by his knowledge of the peculiarities of the work. As a practical rule, he will be well advised to favor the richer, smoother and more mobile mixes in case of doubt. It is regretted that no more precise rules can be laid down, but once the character of the mix has been chosen, the remainder of the problem can be appraised with reasonable accuracy.

The study of the relative economies of like concrete mixes is concerned with three major variables, namely: (1) the price at origin; (2) transportation; (3) yield. A fourth, but less important element, is the cost of unloading by hand shoveling and relates only to the difference in such cost as between gravel and crushed stone or slag.

Methods of mixing and placing and of form construction are important factors in the cost of a yard of finished concrete and are an inviting field for study. Since the character of such methods is changed little for different mixes of the same workability, their influence is beyond the scope of this report. These three variables affect cement and both aggregates, except that in the matter of yield the difference between brands of cement is trivial. The cost at origin is always known, but the transportation cost is often ignored. To the price at origin plus transportation should be added the unloading cost, because it seems most logical to consider material as delivered only when laid down in job storage, viewing unloading as the last step in the general transportation service and, therefore, a part of the cost of the materials. The materials found most economical in producing a mix of given characteristics at any particular point will probably prove cheapest for other mixes there, but the saving of any kind of mix can be found only through actual trial batches.

Influence of Purchasing Methods

It should be pointed out that present methods of purchase have certain inherent evils. The purchase of sand or other fine aggregates by volume results in frequent and wide variations due to the bulking effect of contained moisture. Moisture plays a small part in the bulking of the usual coarse aggregates but there are marked differences in the amounts of solid matter contained in commercial volumes of different materials. A well graded gravel and a badly graded crushed stone are fair examples of the two extremes. Purchase by weight at origin offers an incentive to sell as much water as possible at aggregate prices.

Purchase by weight at destination not less than 24 hours after loading, although disregarding differences in specific gravity, would be better but it would be restricted to stations having track scales. The only usable part of the aggregate is the solid matter; the voids make no contribution toward concrete yield. The ideal basis of purchase would be that of a price per unit of solid matter.

[Following this, the report presented detailed instructions for a method of selecting the most suitable mix for any desired water-cement ratio on any given aggregates, as well as a method for determining the yield of the mix, and from the yield, the quantities and the cost of the materials required per cubic yard of concrete.]

Practical Tests

It is as necessary to test the aggregate for mortar or concrete as it is to test cement. Sand and stone for all classes of work should be tested in a well equipped laboratory and the tests should be made before any aggregates are purchased.

All materials should be checked for uniformity as delivered, and sand should be tested regularly as construction work progresses. Samples of sand and gravel or stone from commercial plants should be taken from the bins or storage piles. No sand and gravel or stone should be sampled as separate units and shipped in that order. Samples of bank run gravel should consist of at least 100 lb. of material, samples of sand should contain at least 20 lb. of material, and samples of gravel or stone should contain at least 50 lb. of material.

After establishing by test the suitability of sand and stone for any desired grade of concrete, it is necessary to see that the size, grading, and proportions of these materials are reasonably constant, to insure uniform quality. The regular and systematic testing of the size of the aggregates gives data that show, without further tests, whether the aggregates will produce a better or a poorer concrete than that produced by the original or standard sample. Indica-

tions of a particular rock's durability may be obtained from an examination of the quarry or the stock pile. Estimate the amount of weathered rock debris at the foot of the quarry face or the amount of disintegrated material in the stock pile, comparing these findings with the length of time exposed, the severity of weathering and with other aggregates, the sources of supply of which are known to be good.

Mechanical Tests

The mechanical analysis consists in separating the broken stone, gravel or sand into the various sizes of which it is composed and may be shown on a curve. To determine the relative sizes of the stone and sand, the different sizes are separated by screening the material through successive sieves of increasing fineness. The sums thus obtained are expressed as percentages of the total weight. When many tests are to be made, it is convenient to have a printed cross section form, with spaces for filling in the number of the tests, description of material, location of the work and other facts.

One of the most dangerous qualities to be found in aggregates is organic impurities, such as tannic acid or its salts, caused by dead leaves, bark, etc., in sand and gravel. Such impurities seldom exist in crushed stone. This test may be determined by the colorimetric test for sands, as described on Page 57 in the Portland Cement Association's booklet on "The Design and Control of Mixes."

Tests for Silts

A test is very important to determine the total amount of silt, loam, clay, etc., in sand and gravel. Each of these impurities carries injury to mortar or concrete when it occurs in such amounts as to ball up and stick together when wetted, which often remain in lumps in the finished concrete. The best method of testing sand is to follow the American Society for Testing Materials standard method of decantation test for sand and other fine aggregates, Serial Designation D-136-28.

An approximate test for use in the field may be made by the sedimentation test of dried sand. Pour the dried sand to the 14 oz. mark in a 32 oz. graduate bottle and then add clear water until it reaches the 28 oz. mark. The sand and water in the bottle are then shaken vigorously and allowed to settle for one hour. If more than one ounce of sediment appears, the sand should be rejected unless it can be thoroughly washed. The maximum amount of silt, loam or clay, etc., in either aggregate should not exceed five per cent by weight. Gravel coated with impurities is also injurious to concrete. It is just as necessary to make a test to determine the amount of silt and clay, and the maximum amount should not exceed two per cent by weight of combined aggregate. Crushed stone generally contains very little silt or clay, but it should be tested if the crushed dust appears to be heavily coated on the stones.

Structural qualities can sometimes best be determined by testing with a hammer. The aggregates shall consist of hard, strong and durable particles. Shale and stones laminated with shale should not be used.

Chemical Analysis

Chemical and microscopic examinations should be made of stone prepared for any work. Generally a physical test is of greater value. It is often necessary to distinguish a calcareous or limestone sand. Limestone is determined by tests with dilute hydrochloric acid. If the material effervesces, it is either limestone or magnesium composition. A good grade of limestone will effervesce more slowly than either of the other classes, and, with no coloring in solution, indicates that there is practically no clay or organic impurity in the stone. Dark shaly colored limestone should be investigated very carefully, as often the test proves that this particular class of stone is composed largely of clayey substances. This composition can be found by laboratory analysis. Natural gravel aggregates, although very thoroughly washed, should be chemically analyzed, especially aggregates that are heavily coated with a dark brown coloring. Aggregates of this nature are often composed of sandstone, which, if high in porosity, may contain a large percentage of organic impurities. As a general rule, all gravel aggregates should be thoroughly tested as to composition.

Tests for Consistency

This test should be made frequently to assure the uniform mixing of concrete during the process of the work. This is made according to the slump test, as described in the American Society for Testing Materials, Serial Designation D-139-26-T.

Materials should be checked from time to time to see if they are suitable for the work in process. To control the concrete properly, it is necessary to make tests of the aggregates so that uniform batches may be made by making changes in the proportions on account of the variations in the aggregates as delivered.

Committee: F. H. Cramer, chairman (C. B. & Q.), H. C. Munson, vice-chairman (C. M. St. P. & P.), H. I. Benjamin (S. P.), A. I. Gauthier (B. & M.), W. A. Hutcheson (C. & O.), A. C. Irwin (Portland Cement Association), W. S. Lacher *(Railway Engineering and Maintenance)*, R. W. Mitchell (B. & O.), W. V. Parker (St. L. S. W.), T. W. Pinard (Penna.), Geo. Sawyer (D. & H.), and G. E. Tebbetts (C. R. T.).

Discussion

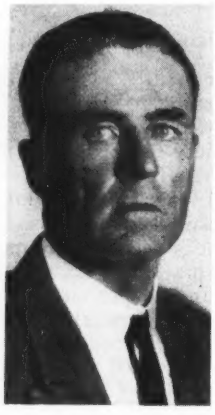
In the discussion of the report, A. C. Irwin (Portland Cement Assoc.) stated that future developments in the mixing of concrete will tend to the perfection of field methods to utilize the scientific knowledge now available. He stressed the importance of proper attention to the mixing of concrete and cited the practice of a midwestern road of requiring contractors to use only mixes of approved type and demonstrated efficiency. T. Turnbull (Ann Arbor), inquired if there was any advantage in using some

McGarry, Cavins and Higgins Were Popular with the Ladies

sharp crushed stone with smooth rounded gravel in concrete aggregate, to which Mr. Irwin replied that the only effect would be to make a slightly harsher concrete.

A. I. Gauthier (B. & M.) pointed to the fact that it is the cement that makes concrete expensive and that the most economical concrete is that which yields the most concrete of a given strength from a fixed amount of cement. Large aggregate, he said, tends toward cheaper concrete. L. M. Bates (C. & N. W.), recalled the fact that 1-3-6 concrete used to be considered the cheapest mix, whereas today it is frequently known to be the most expensive. On his road the yardage of concrete per barrel of cement has been increased materially this year, while the quality of the concrete has been improved.

The Maintenance of Water Transport Facilities for Railway Equipment



C. W. Boyce, Chairman

THE REPORT presented by the Committee on the Maintenance of Water Transport Facilities for Railway Equipment, opened with a detailed statement of the car-ferry facilities maintained by the railways of the United States across navigable streams and the Great Lakes, as well as in various harbors. This was followed by a description of the inclines and cradles required for the transfer of cars from land to the boats, with considerable detail relative to their construction.

Pile clusters were discussed in a description of the Yazoo & Mississippi Valley facilities at Vicksburg. It was found after several years of experimenting that the best results are obtained by driving these piles in clusters of 20, with the butt end down, and driving them as close together as possible and securely wrapping them with a ⅝-in. chain about 60 ft. long, making as many turns as this length will allow. All kinds of ties have been used but a chain is found to be the best.

Shifting Sand Bars

Shifting sand bars were a source of trouble at Vicksburg. These inclines have been kept open under some very difficult circumstances, on account of current changes causing the river to fill in sand around the incline at times, and then change and wash it out. The conditions usually change after each high stage of the river.

In 1927, after a spring rise, the river filled in on the Louisiana incline, forming a sand bar at the lower end, so that boats could not pass into the cradle. A temporary trestle horn was driven out into the river from the incline, at an angle of about 45 deg., to get to water deep enough to land. This was used for about two months, until the next rise in the river. Fortunately, when this rise came, the river did not fall any more that season to a stage low enough to require the use of the horn. After the next spring rise the current changed and washed out the sand bar, so that the regular incline tracks could be used again.

The renewal of submerged trestle inclines often introduces problems, as illustrated in the description of work done on the Missouri Pacific transfer to St. Louis.

It was attempted to drive piling, to replace the old bents, but on account of high water it was found almost impossible to do this; consequently, the old caps were pulled off and new caps were replaced. These caps were applied by bolting the rail on each side, boring the cap and then drift bolting in the usual manner, by a ramrod through a piece of pipe. Some few piles, however, were driven where the others were missing. This was done by driving the piling to a cut-off elevation, avoiding the cutting off of the piling in the water.

The new deck consisted of 3-ply 8-in. by 16-in. by 28-ft. stringers under each rail. Part of the ties were full length ties for a double-track incline, which held everything to gage. A row of piling was then driven about 50 ft. apart on each side down the incline, upon which caps were placed and the deck suspended from these caps with block and tackle. Two push cars, heavily loaded with rails, were lowered down the incline, bolting the deck to the caps as the cars went down.

Ferry Slips on the Ann Arbor

Difficulties with the ferry slips of the Ann Arbor Railroad on Lake Michigan and some suggestions growing out of them were discussed as follows:

Troubles experienced with these slips have been various. The slip sides require almost continuous supervision and work, especially on the outer end and on the knuckle, because of breaking or wearing of the fenders and piles and waling timbers, caused apparently by not building the slip sides, especially the outer end, strong enough to sustain the shock of the boats, and the continual wearing away of the fenders by the boats. Much trouble has been experienced with aprons, or tables, being torn loose, or loosened up at the hinged end by the shock of boats entering the slip and by the loading and unloading of cars.

The conclusions of the committee in regard to water facilities were that the slip sides, especially for the knuckle and the outer or bow end of the slip, should be built much stronger. All piling should be of white oak, rock elm, or some other wood that is not brittle and will stand a large amount of bending without fracture.

With piling and reinforced-concrete, a head-line cleat could be embedded in the concrete so that the line could be unloosed from the cleat automatically when the boat pulled away from the slip. Permanent and safe walkways would be provided for men getting from the boat to the tieup cleat. The apron, or table, should be of a standard length of from 50 to

55 ft. and made as shallow as possible. It would be hinged directly to a 50-ft. steel approach, with compression and tension connections at this end to take up the shock of boats and cars. The approach would have pile and concrete foundations, the concrete being placed to reach below the lowest water level, and furnished with approximately three sets of shoes, one, two and three feet in height.

Committee: C. W. Boyce, chairman (Y. & M. V.), F. J. Welch, vice-chairman (C. M. St. P. & P.), T. W. Bratten (S. P.), R. J. Bruce (M. P.), J. B. Livingston (St. L. S. W.), C. U. Smith (Harbor Terminal Director), M. A. Smith (I. C.), B. F. Stidfole (P. R. R.), E. D. Story (F. E. C.), E. E. R. Tratman (Engineering News Record), and T. B. Turnbull (Ann Arbor).

Discussion

Although relatively few members of the association are concerned with the problem of maintaining car ferry inclines and cradles, the activity of the discussion showed the intense interest of those who are confronted with this problem. In reply to a question, Chairman Boyce stated that it is his practice to drive cluster piles with the large end down, as he has found that they are stronger when driven in this manner. He then ties them together with chains. A. L. McCloy (P. M.) advocated the installation of short aprons in harbors subject to ice because of the fact that tugs and other boats crowd the ice under the aprons, requiring men to chop it out to avoid dislodging the aprons. This ice also tends to crowd boats away from the fender piers and prevents them from engaging the aprons properly.

C. R. Knowles (I. C.) pointed to the difficulty in keeping slips free from mud, particularly in silt-bearing streams. In some cases the Illinois Central has installed pumping facilities and pipe lines for the removal of this mud by laying pipe on the cradles with nozzles located on the outside of the wheels to create an artificial current along the rail. At Baton Rogue, La., such an installation, made at a cost of less than $1,000, resulted in a saving of over $3,000 per year in tug hire.

The Elimination of Accidents to Men While Working off the Ground

W. R. Roof
Chairman

THE number of accidents can be reduced if the supervising officer enforces simple and effective rules against the unsafe habits of his workmen. A careless workman is not only a menace to himself but to the workmen about him. Following is a discussion of the common causes of accidents and recommendations for their elimination.

Work clothes should be comfortable and loose enough to permit freedom of action. They should not be so large or baggy that they may be caught or snagged on spikes, projecting timbers, or steel. Overalls should not be turned up at the bottom unless securely stitched.

Shoes should be of medium weight, comfortable fit, and warm enough to keep the feet comfortable in winter work. Loose soles, holes in soles, and run-down heels should not be permitted on the job at any time. Metal heels and toe plates are unsafe. Rubber heels, or better still, rubber soles and heels, generally afford a good grip on scaffolds or structures. Hats, caps, or other head gear should not have limber or flappy brims or visors, as sudden gusts of wind may obscure the workman's vision at a critical moment. Gloves should be well fitting and comfortable. Cumbersome gloves or mittens should be avoided when possible. In some cases, gloves with a thumb and one finger, the rest of the hand being encased in a sort of mit, are better than gloves with one thumb and four fingers.

Dull tools are more dangerous than sharp ones. Tools intended to be sharp should be kept sharp. Hammers and mauls with bad faces or cracked handles are unsafe at all times. Mauls or hammers used in top work must be tight handled, true faced, and well balanced. Care must be exercised to keep maul or hammer faces free from grease. If these defects are not corrected they may cause mauls or hammers to glance or cause spikes or pins struck by them to fly.

Jacks should be of the kind that are adapted to the particular kind of work under way. For use on scaffolding, they should be the high geared, short lever, ratchet style. The ordinary track jack should never be used where the footing of the operator is limited or where there is not ample room for a long sweep of the lever.

Care should be exercised in setting jacks and no chance taken of their being kicked out from under the load. Tools, spikes protruding from planks or other pointed or sharp objects must not be left standing upright.

Worm wrenches, or those with loose jaws, may spread so that they will slip, and they are, therefore, dangerous. Pulleys, ropes, blocks, chains, hooks, needle beams and planking should be in first-class shape and whenever one is in doubt that they are of full strength, they should be discarded. The use of defective tools is an actual hazard with the further annoyance and loss of morale which comes from the use of inferior equipment.

Many accidents occur during the dismantling of old structures which are being removed because of old age or defective parts. The foreman in charge should be familiar with the function of each part of the structure and the result of the sudden removal or displacement of it. He should know how and where to support partially dismantled work. Foremen engaged in such work should be fully qualified with years of experience.

Scaffolding

Every scaffold should be constructed of material of sufficient strength to carry its intended load and must be securely fastened together. In a swinging scaf-

fold, the needle beams, ropes, cables, hooks, or steel rod loops must have ample strength, and all hitches be made secure. Foot planking should be free of knots, straight grained, and lie in a true plane. Excess tools and material should not be placed upon the scaffolding. Anything on a scaffold is a potential danger to the workmen below. Wherever possible, toe boards of sufficient height should be installed on the floor boards to prevent tools from rolling off.

Workmen should exercise care in passing each other on scaffolds and they should give freedom of passage to workmen engaged in work. Jacks should be lashed to the fixed structure while in use and while not in use. If there is any doubt in the mind of the man in charge that the scaffolding or any part of it is not of sufficient strength, he should not, under any circumstances, permit any of his men to work upon it. The man in charge should pick out the men best qualified to erect and work upon scaffolds.

On roofs with a pitch of more than one in six, foot cleats or brackets should be provided; no reliance should be placed on the adhesion of feet or body to prevent the workmen from slipping.

Ladders must be kept in good condition and not be permitted to become shaky and weak. They should not be overloaded, and they should be of sufficient strength to sustain the weight of the workman with material and tools.

Handling Heavy Material

When heavy material is handled by men, team work is necessary. It is important that the men exert their efforts in unison, both in lifting heavy material and in placing it. They must be watchful for the safety of their hands and feet and must pay strict attention to the orders of the man in charge. They should maintain equilibrium for their own safety and for those about them. They must take hold of material in such a manner that instant release will be possible in an emergency. Lug and cant-hooks should be sharp and in good shape and workmen should see that these tools have taken a good hold before telling the other workmen that they are ready. Where heavy material is handled by machinery, the workmen should know the meaning of all orders and signals, and the man giving the orders or signals should do so in a clear voice which can be understood.

There is nothing safer than the "plain timber hitch" if properly made. When a chain is used, it should be what is commonly called the "timber chain" with a slip hook. The use of timber hooks should be discouraged and cable slings, rope slings, or a good chain with slip hooks should be substituted. In the placing of steel work, proper girder clamps may be used in safety. Cable slings may also be used with safety if burlap or other similar material is so placed as to prevent the cutting of the cable on sharp corners.

The workmen should ever be watchful of their positions so as not to be under moving or suspended loads. The operator of the machine must be alert, clear headed, of keen perception in order to carry out signals correctly at all times, and especially so in an emergency. He must understand his machine thoroughly—what it will do and what it will not do. The man in charge should give his signals so as to prevent the moving load from striking a part of the fixed structure and if it should be necessary to do this, he should warn his men in advance as to what is about to happen. Any machine in use should be equipped with such safety devices as will meet the requirements of the National Safety Council.

The physical condition of a bridge or building man is very important and the employer should give this matter particular attention when adding new men to his crews. The human element is by far the most important item to be considered in the elimination of personal injuries. Any man who is affected by altitude or is subject to dizziness or cramps, who has impaired eyesight or a sprained back, or who is reckless and careless of the safety of himself and his coworkers, should not be employed to work above the ground.

Safety First Organizations

Safety organizations are now well established on nearly every railroad in the country. They are gaining the confidence of the workmen and have proved their value to mankind. Like anything else, safety work can be overdone. Too frequent meetings where discussions of previous meetings are rehashed, cause loss of interest among listeners and the readers of reports of the meetings. Changes of subjects and of speakers will arouse the interest of the listeners or readers.

A further method of arousing the interest of the workmen is to set up a safety competition among the various bridge and building gangs. A very simple, workable, and effective method is to send frequent messages to each foreman, advising him of the numbers of days which he has to his credit without a reportable accident. Owing to the different classes of work and the number of men in the various gangs this method may not prove accurate, but it does set up competition and interest, and that is what is desired. The interest may be further stimulated by the award of medals, cups, or plaques of bronze or some similar metal to the gang having the best and longest record.

Education in safety is bound to be successful. An excellent example of what training and education will accomplish is afforded by the experience of one of the eastern railroads in a bridge strengthening and renewal program, involving 48 structures over a period of 15 months.

An excellent safety record was made on this work, due to the education of the workmen along safety lines before the work was started and while the work was in progress. The record follows:

Nature of work	Man hours of work	Man hours lost by injury
Driving piling	14,984	72
Placing concrete piers and abutments	37,596	0
Precast concrete work and installation	4,992	0
Placing new bridge steel and riveting	35,509	0
Removing and handling old bridge steel	6,286	0
Total	99,367	72

The 72 hours lost driving piling was due to the injury of two men, one of whom lost 40 hours and the other 32 hours.

The success of a safety organization depends very largely upon the enforcement of rules. Rules should be few in number and so worded that every workman will have a clear picture of what they mean. A relaxation of discipline invites ultimate failure of any safety organization. The discharge or punishment of a workman or foreman for violation of rules will maintain the morale of workmen who are ever anxious to perform their duties in a safe manner. The sum and substance of this subject can be stated in a phrase known to all:

"The best safety device known is a careful man."

Committee: W. R. Roof, chairman (C. G. W.), L. M. Bates (C. & N. W.), D. C. Barrett (C. & N. W.), W. J. Bennett (G. N.), Charles Harrison (M. V.), F. G. Hawken (D. S. S.

& A.), J. P. Hofacker (L. V.), R. W. Johnson (C. M. St. P. & P.), C. G. Lindstrom (C. M. St. P. & P.), F. H. Masters (E. J. & E.), C. L. Metzmaker (C. & I. M.), A. V. Rohweder (D. M. & N.), and Wm. Shively (C. R. R. of N. J.).

Discussion

Following the presentation of this report numerous members suggested other measures for the reduction of accidents to employees. C. M. Burpee (D. & H.) suggested that foot boards be fastened when men are working on scaffolds and that all ladders be striped for the protection of men working on the ground as well as those on the ladders. A. I. Gauthier (B. & M.) stated that he has had two serious accidents during the last year due to the use of chains and as a result, has since substituted cable. E. C. Neville (C. N. R.) emphasized the necessity of training foremen in the tying of safe knots. C. W. Wright (L. I.) stated that on his road men are forbidden to accept tools from a storekeeper that are not fit for use.

C. R. Knowles (I. C.) discussed the hazards arising in the application of hoops to water tanks and quoted from instructions in effect on that road to avoid accidents in this operation. He cited a fatal accident that resulted from a foreman failing to provide a safety hand rail on scaffolding and another serious accident caused by a man throwing a plank from the roof of a tank, a nail in which caught the coat of a workman and pulled him off.

The Inspection and Maintenance of Track Scales

E. Kent Lawrence
Chairman

THE experience of the United States Bureau of Standards, which has tested track scales throughout the country, is that, regardless of design, nearly all scales can be kept in correct weighing condition if they receive the necessary inspection and maintenance. In many cases, however, the cost of maintenance would be prohibitive and the economical solution of the problem is the replacement of scales with others of approved design to meet the particular requirements.

A normal scale organization should consist of a supervising officer, scale inspectors and scale builders. For efficient inspection and economical maintenance, all parts of the scale should be accessible. The pit should be easily accessible, waterproof, well lighted, ventilated and should have good drainage. To obtain these results, the supervising officer should pass on all plans. The construction of the scale should be under the supervision of a competent scale inspector or scale builder. The best results can be obtained by constructing the scale with company forces, rather than by contract.

Inspection and Test

The scale inspector should inspect and test scales at regular intervals, not to exceed 90 days. Weekly or more frequent inspections and prescribed tests should be made by the weigh-master or other authorized party having a general knowledge of scales and their operation. The inspection of scales by the scale inspector should include the following features:

Tracks; condition of ties, rails, joints, switches, line and surface, clearance between scale and approach rails (which should be between limits of ½ in. and ¾ in.) and condition of easer rails.

Deck; general condition as to cleaning, physical condition, clearance about dead structure, if it has a floating deck, or movable scale parts if of rigid construction.

Weather or Dirt Shields; physical condition; clearance between dead and live parts.

House; general condition as regards care and orderliness; physical condition.

Scale Pit and Foundation; general condition, care and cleaning; physical condition, drainage, lighting and ventilation.

Steel Superstructure; general condition care and cleanng; physical condition; clearance between fixed and movable parts, with a limit of not less than ¾ in.

Checks; physical condition; adjustment.

Scale Lever Stands; stability and immobility.

Scale Levers; condition of pivots and bearings; relative position of pivots and bearings; binds, levers, or pivots; level and alinement of levers; plumb connections.

Weigh Beam; binds; level; wear in notches; cleanliness and legibility of markings.

Poise; free running; seating in notch when released: wear of dog.

Type-Registering Beam; condition of type and type bar; condition of recording mechanism.

In case the inspection discloses an irregularity which would affect weights, a test should be made before the condition is corrected. This test should be made with one or more cars of an approved type, sealed to a specified weight, the weight to be multiples of 10,000 lb. and not less than 30,000 lb. When two or more cars are used, one should be 30,000 or 40,000 lb. and one 80,000 lb. or heavier. Test cars should be calibrated at least every six months and at such other times as there is an undetermined change in weight due to repairs or other causes.

In making the test, the weigh beam should be tested for balance and the sensibility reciprocal of the beam determined before the load is applied. The scale should be tested first with each car separately and weight indications of the beam taken with the car close up to each end, free from the approach rails or other fixed parts, and at each intermediate section. The car may then be spotted centrally over each intermediate section or immediately to the right and left of each section and the sensibility reciprocal of the beam determined with each car. Two test cars are next placed on the scale and the weight indications of the beam taken with them in separate positions and then with the cars coupled up and spotted at each end and in the center of the scale and the irregularities found on inspection then corrected.

The test should be repeated with the cars and the levers adjusted if necessary, the adjustment being made preferably to the heaviest car. Repeat the test after adjustment. When convenient, one or more heavily loaded, short wheel-base cars should be weighed at either end and in the center of the scale. On scales equipped with a motion weighing machine,

the cars after being weighed by the beam should be weighed with the machine spotted on the trip end and in regular operating motion. One or both test cars should be spotted on the scale and the loads and weight indication of the beam taken.

The weighmaster should inspect the scale at regular intervals, at least weekly, to assure himself that the scale levers and moving parts of the scale are free from binding against fixed parts; that the bearings and pivots are in proper contact; that the connections between levers are in order, and that there are no broken parts. The weighmaster should check the balance of the weigh beam; should weigh in three positions, at each end and in the center of the scale, two or more short wheel-base, loaded cars, selecting preferably cars previously weighed on other scales and on scales equipped with motion weighing machines, each car being weighed with the machine in regular operating motion and also spotted on the trip end of the scale. He should record the weight in each position for each car and the weight ascertained previously on another scale if available, and forward the report to the supervising officer, retaining a copy for his record.

Maintenance

An annual inspection should be made of all scales in the fall and the maintenance program made up for the required repairs, renewals or replacements for the ensuing 12 months. Regular maintenance must insure that the tracks on approaches are in line and surface; that the joint between weighing and approach rails is open from ½ in. to ¾ in.; that the deck is clean and free from binds; that the use of salt to thaw ice or prevent freezing is prohibited; that the steel superstructure is clean; that the bearings and pivots are clean and oiled, and that the pit is cleaned and drained. Track laborers employed in such maintenance should be assigned regularly to this work and be instructed as to the requirements by the scale inspector. It is a good practice to pack loops and bearings with suitable cup grease, which should be renewed at least yearly, under the supervision of the scale inspector. Cup grease should not be used in any bearing or loop closer to the weigh-beam than the fulcrum bearing of the transverse lever. Where the use of grease has a tendency to loosen up pivots, that portion of the pivot seated in the lever should be shellaced or painted with lead by the scale inspector. Structural steel, except when the deck is removed for renewal and is accessible for thorough cleaning and painting, can best be maintained by painting or spraying with heavy oil. The oil will seep into inaccessible points and will penetrate beneath the rust scale, loosening it up and arresting further corrosion.

All repairs to scale levers or connections should be made by or under the supervision of the scale builder. General renewals and replacements should be handled by the bridge and building forces under the supervision of the scale inspector or scale builder. When conditions warrant, renewals or replacements can be handled more efficiently and economically with a special scale builder force.

Committee: E. Kent Lawrence, chairman (B. & O.), H. H. Best, vice-chairman (M. P.), G. A. Easton (S. P.), J. S. Ekey (B. & L. E.), V. E. Engman (C. M. St. P. & P.), R. H. Gilkey (C. of Ga.), H. A. Horning (M. C.), A. L. McCloy, (P. M.), C. E. Miller (C. & N. W.), C. Pettis (N. Y. C.), L. C. Smith (I. H. B.), and H. E. Wells (A. T. & S. F.).

Discussion

W. T. Krausch (C. B. & Q.) stated that it is the practice of the Burlington to test all track scales four times a year. To avoid a division of responsibility between the scale inspectors and local division officers, it is the practice on his road for the master carpenters to accompany the scale inspectors on their territories and to participate in the inspection. Small repairs are made by these inspectors, while, where heavier repairs are necessary, the scale is taken out of service until these repairs are made. Every effort is made, however, to avoid the latter procedure.

A number of members showed active interest in the use of oil in place of paint for the protection of scale parts. A. L. McCloy (P. M.) advocated the use of a paint spraying machine for the application of the oil, because of its ability to force the oil into locations inaccessible with the brush. E. A. LeWald (A. T. & S. F.) and others, however, urged the use of red lead on metal parts of scales as affording the maximum protection.

Exhibit of Bridge and Building Supplies

WHILE the number of companies participating in the exhibit of the Bridge and Building Supply Men's Association was smaller than in any recent year, 48 companies presented their products. As in past years, the exhibit consisted largely of literature and models, although a number of companies presented full-size units of their various products.

The officers who served this association during the past year were: President, D. A. Hultgren, Massey Concrete Products Company, Chicago; vice-president, W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; treasurer, B. J. Wilson, Pocket List of Railroad Officials, Chicago; secretary, I. B. Tanner, Joseph E. Nelson & Sons Company, Chicago.

At the annual election on Thursday morning the following were selected to serve for the ensuing year: President, W. D. Waugh; vice-president, I. B. Tanner; treasurer, B. J. Wilson; secretary, W. H. Lawrence, Johns-Manville Corporation, New York City. Directors: S. A. Baber, High Grade Manufacturing Company, Cleveland, Ohio; J. M. Rutherford, *Railway Engineering and Maintenance*, Chicago; C. H. McCormick, the Ruberoid Company, New York; E. G. Whitmore, the DeVilbiss Company, Toledo, Ohio; B. S. Spaulding, Fairbanks, Morse & Co., Chicago; E. E. Kelly, Celotex Company, Chicago.

The names of the companies participating in the exhibit, together with the nature of their displays and the names of their representatives follow:

American Hoist & Derrick Company, St. Paul, Minn.; literature and photographs of locomotive pile drivers, derricks, crawler cranes, locomotive cranes, railroad and locomotive ditchers; B. R. Roquemore and Miss H. M. Hoeller.

American Rolling Mill Company, Middletown, Ohio; samples and literature on ingot iron; H. M. Arrick, W. W. Graham and E. Harbeck.

American Valve & Meter Company, Cincinnati, Ohio; model of water column with universal spout and stock drencher; John I. McGarry and Dan. J. Higgins.

Argyle Railway Supply Company, Chicago; literature on stoves; A. H. Green.

The Barrett Company, New York City; Walter Buehler and F. N. Nichols.

Carter Bloxonend Flooring Company, Kansas City, Mo.; flooring; J. G. Galvin.

Celotex Company, Chicago; Celotex products and literature; E. S. Kelly, J. H. Bracken and D. J. Carmouche.

Chicago Bridge & Iron Works, Chicago; literature and photographs of steel water tanks; H. C. Brown.

James B. Clow & Sons, Chicago; automatic water closet, two-inch cast iron pipe, water main hydrant and lavatory faucets; Walter O'Day, John Madison, H. H. Dawson and W. J. Layman.

Dearborn Chemical Company, Chicago; samples of chemically compounded rust preventive; C. F. Barham.

Detroit Graphite Company, Detroit, Mich.; samples of metal protective paints; W. D. Waugh, L. F. Flanagan and A. B. Edge.

The DeVilbiss Company, Toledo, Ohio; paint spray systems for bridges and buildings; E. G. Whitmore and O. E. Wilcox.

DeWalt Products Corporation, Leola, Pa.; woodworking machinery, cutting machines, and machines for dapping bridge timbers and ties; L. J. McLaughlin.

Paul Dickinson, Inc., Chicago; caboose jacks, cast iron chimneys, roof ventilators, deck and roof drains and cast iron exhaust heads; A. J. Filkins and A. E. Engman.

Joseph Dixon Crucible Company, Jersey City, N. J.; literature and samples of graphite paint and lubricants; E. M. Brooks.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.; high speed screw jacks with foot lift, standard speed screw jacks with foot lift, ratchet and geared ratchet jacks and journal jacks; Albert Roberts and Earl Thulin.

C. A. Dunham Company, Chicago; literature on heating system and specialties; C. F. Roscoe and L. W. Millar.

Fairbanks, Morse & Co., Chicago; F. M. Condit, C. H. Wilson, C. B. O'Neil, H. J. Smith, E. C. Golladay and L. H. Mathews.

Fairmont Railway Motors, Inc., Fairmont, Minn.; bridge and building gang motor-cars and motor-car headlights and windshields; Kenneth K. Cavins, Ward G. Day and K. M. Simpson.

Federal Engineering Company, Chicago; W. H. Nelson.

Hastings Signal & Equipment Company, Boston, Mass.; telltale hanger and side clearance warning device; R. W. Hastings and Harry H. Nayor.

High Grade Manufacturing Company, Cleveland, Ohio; literature and samples of fibre cement; S. A. Baber and J. N. Kinn.

Ingersoll Rand Company, New York City; literature on compressed air equipment for bridge and building work; W. H. Armstrong, G. W. Morrow and W. H. Lee.

Ingot Iron Railway Products Company, Middletown, Ohio; model demonstrating the method of jacking culverts through embankments and section of perforated pipe and section of paved pipe; N. A. Powell, T. Scott and R. Y. Barham.

The Insulite Company, Minneapolis, Minn.; samples of wood fibre insulation board and a model showing its application in building construction; R. J. Wilde and R. M. Jordan.

Johns-Manville Corporation, New York City; roofing materials, pipe and boiler insulation, waterproofing, industrial flooring and smoke jacks; W. H. Lawrence, A. C. Pickett and D. B. Bell.

Jones Paint Company, Rome, N. Y.; liquid and plastic roofing cement; A. de Wolfe Jones.

The Kaustine Company, Inc., Perry, N. Y.; literature and models of chemical toilets and septic closets; Charles F. Smale and David A. Evans.

The Lehon Company, Chicago; samples of asphalt roll roofing, asphalt built-up roofing, membrane shingles, waterproofing and roof coatings, and asphalt emulsion; Tom Lehon and J. W. Shoop.

Lewis Asphalt Engineering Corporation, New York City.

Massey Concrete Products Company, Chicago; literature on reinforced concrete culvert pipe, cribbing and piling, also photographs; David A. Hultgren, C. H. Hunsacker, J. A. Higgs, Jr., and W. L. McDaniel.

Murdock Manufacturing & Supply Company, Cincinnati, Ohio; hydrants, railway water service boxes, wall fountains and air valves; J. C. Endebrock and J. C. Endebrock, Jr.

Joseph E. Nelson and Sons Company, Chicago; I. B. Tanner.

National Lead Company, New York City; literature on red and white lead; F. E. Dodge, W. S. Carlisle and L. L. Hopper.

Northwestern Motor Company, Eau Claire, Wis.; heavy duty motor car; W. J. Church.

W. W. Patterson Co., Pittsburgh, Pa.; steel tackle blocks for wire cable and wood tackle blocks for manila rope; W. W. Patterson, Jr.

The Patterson Sargent Company, Cleveland, Ohio; L. J. McComb.

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa.; photographs and literature on steel water tanks and treating plants; O. D. DeHart and W. R. Workman.

Pittsburgh Plate Glass Company (paint and varnish division), Pittsburgh, Pa.; paints; W. T. Carey and P. B. Truslow.

Pocket List of Railroad Officials, New York City; copies of publication; B. J. Wilson.

Railway Engineering and Maintenance, Chicago; copies of Railway Age and *Railway Engineering and Maintenance;* Elmer T. Howson, J. M. Rutherford and J. G. Little.

The Geo. J. Roberts Company, Dayton, Ohio; literature on railroad water treating plants; John C. Jamieson.

H. H. Robertson Company, Pittsburgh, Pa.; samples of protected metal roofing and siding, ventilators, skylights, sash and V-beam sheets; H. D. Sheets, E. H. Wasmuth, R. B. Archer and J. R. Nichols.

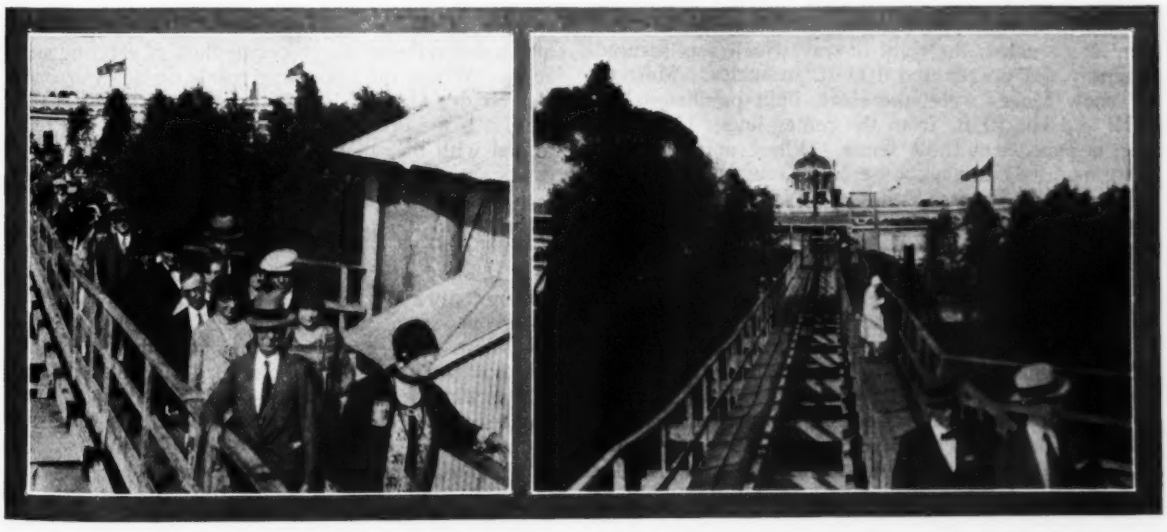
Wm. Robertson & Co., Chicago; Wm. R. Robertson.

Sherwin Williams Company, Cleveland, Ohio; H. S. Donnely and Arthur Larkins.

U. S. Wind Engine and Pump Company, Batavia, Ill.; literature on tanks, steel towers, water columns and tank fixtures, also models; C. E. Ward.

Wolverine Porcelain Enameling Company, Detroit, Mich.; porcelain enameled roof tile; Frank C. Kingsland.

Zitterell Mills Company, Webster City, Iowa; G. C. Mills.



Leaving the Steamer at the Celotex Plant

At the Celotex Plant—All Aboard for New Orleans

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE JANUARY ISSUE

1. *When applying fastenings to rails, should the bolts at the middle or those at the ends of the joints be tightened first? Why?*

2. *What provision should be made on truss and girder spans and viaduct towers to facilitate access to all parts of the structure for inspection and painting?*

3. *What is the minimum stock of ties that should be carried on an outlying section during the winter? What determines this?*

4. *Can the incrustation of discharge lines at water stations be prevented or reduced? If so, how?*

5. *What method, if any, can section forces use to reduce the rail wear on curves?*

6. *Is it permissible to construct a timber trestle partly of treated and partly of untreated material? If so, under what conditions?*

7. *Should a section gang in a large yard also be required to maintain the main tracks through or beyond the limits of the yard, or should this be assigned to a main track gang?*

8. *Is it desirable to maintain a uniform force of painters throughout the year, and if so, what painting can be done during the winter?*

Placing Snow Fences

Should snow fences be set parallel with or at an angle to the track, and if the latter, at what angle? How far back from the track should they be placed?

Conditions Vary the Requirements

By C. F. WOMELDORF
Division Engineer, Chicago & North Western, Norfolk, Neb.

In general, the placing of snow fences depends upon the direction and velocity of the wind, also on the depths of the cuts to be protected. At the time when most of the railroads throughout the western states were constructed, the right-of-way which was secured generally did not exceed 100 ft. in width. Most of the snow fences were, therefore, built parallel to the track and but 50 ft. from the center line. This, as a rule, is permanent snow fence. Where portable snow fence is used it may be set back further from the track and this is often done where the cuts are heavy. Many deep cuts in exposed positions are protected with five or six lines of portable snow fence. Such snow fences are set from 100 to 200 ft. apart and are usually built at right angles to the direction of the wind. In setting snow fences back beyond the limits of the right-of-way, it is necessary, of course, to secure the permission of the land owner.

A great many considerations enter into this problem. For example, snow fence is required in an open prairie country, but is not necessary in a country that is heavily timbered or sometimes where the land is under cultivation. A good corn field, for instance, is a better protection against drifting snow than a snow fence.

In this western country we have a great variety of snow fences. At some places we have permanent fences, and in others we have used, for many years, a portable fence of our own make, setting it back beyond the limits of the right of way. Lately, however, we are purchasing a manufactured slat snow fence, such as is being used by the highway departments of many western states.

Depends on the Direction of the Wind

By ENGINEER OF MAINTENANCE

The topography of the country, the state of cultivation, the amount of snowfall, the type of fence and the intensity of the prevailing winds, all have their influence in determining the proper method of erecting snow fences. Where the prevailing winds do not vary more than 30 deg. from a direction at right angles to the track, it is usually satisfactory to place the snow fence parallel with the track, although, in some cases, better results are obtained if the fence is set at a slight angle to bring it more nearly perpendicular to the direction of the wind.

If the wind strikes the track at an angle of less than 30 deg., snow fences are, as a rule, unnecessary. Yet it is not always safe to eliminate them, because, in any given storm, the direction of the wind may not fall within these limits. If the direction of the prevailing winds lie, in the middle third of either quadrant on the windward side of the track, the snow fence should be placed at an angle of about 45 deg. with the track, in sections of about 150 to 200 ft. The experience gained from previous winters is usually a sufficient guide to determine whether the fence should be placed parallel with or at an angle to the track, and if the latter, the magnitude of the angle.

The distance from the track which will give the best

protection is usually determined by the height of the fence, the amount of snowfall, the intensity of the wind and depth of the cut. For light cuts, one line of snow fence 50 ft. from the track may be sufficient. For deeper cuts an additional distance, equal to the greater distance of the top of the cut from the center line is usually required. These distances may vary from these figures, however, if the snowfall is heavy and high winds prevail. With the usual form of snow fence the slope of the snow bank behind the fence is roughly from 1:12 to 1:15, so that the height of the fence used will determine the distance that it should be set from the track to give best results.

In many localities, the total snowfall is so great that a single line of parallel fence or a single group of lines of slanting fence is insufficient. In such cases, from one to five additional lines are sometimes necessary, and the distance which should be maintained between them for best results can be determined roughly in the manner indicated.

Returning Tools Over Winter

Is it advisable to return to the stores department, or some other central point, over winter, the extra tools that are used by enlarged section gangs during the summer season, or should they be allowed to remain in the section tool houses?

They Should Be Returned

By Robert Faries

Assistant Chief Engineer Maintenance, Pennsylvania, Philadelphia, Pa.

Control of the great number of tools which are normally distributed over a railway is difficult, even when it is systematized, and can be made effective only by some periodical check of the number of tools on hand and their location. Since the requirements for the different tools used in maintenance varies with the renewal programs from year to year, it is necessary to shift them around and, if they are left in the tool houses, the difficulty of doing this is increased.

The winter months, when these tools are idle, offer a convenient opportunity for making repairs. This is especially true of machine tools such as tie tampers and other tools used in ballasting and rail renewals, which should have a general overhauling and should be checked up annually.

There is no justification for retaining tools on the section, over winter, in larger quantities than are required by the winter forces, since, in many instances, such a practice makes it necessary to purchase similar tools for other places and other work. In view of this fact, it is my opinion that the best system, tending toward a better control and a better distribution when needed, is an arrangement whereby all surplus tools, over and above those actually required by the winter forces, are sent to the storehouse late in the fall, repaired if necessary, and redistributed in the spring.

Holding Surplus Tools Leads to Waste

By Roadmaster

As I understand the question, it does not refer to extra gang equipment, but only to the tools used by regular section gangs, which, under the system of seasonal employment, are considerably enlarged during the summer months and reduced to a minimum over winter.

Small tools constitute so important a part of the maintenance equipment of a railway, that any laxity in their control is sure to result in considerable waste. Every supervisory officer is aware of the tendency of section gangs to accumulate tools beyond their requirements, and the reluctance with which they let go of them, even after they are badly worn or damaged. For this reason, if any sort of control is to be exercised over the distribution of this equipment, a periodical check of the tools on the various sections is necessary and is one of the fundamental requirements by which such control can be made effective.

The regular practice of allowing tools to remain on hand during extended periods, when they are not needed, will always result in laxity and more or less indifference in handling and caring for them so that it is generally wasteful. A check of the tool costs of a supervisor who permits this practice will invariably reveal that his costs are measurably higher than those of supervisors who watch their tool distribution more closely. Furthermore, tools that are idle represent an investment which is bringing in no return, while many tools will be found on such districts which are unfit for use because they are out of repair, and which eventually find their way into the scrap car, but which could be made usable at small cost.

The tool requirements on different sections of a railway vary with the amount of repair and renewal work, so that what may be a normal requirement for a district for one year may be above or below the requirements for succeeding years. Since this is true, unless effective control is established, new tools will be purchased instead of shifting the surplus to the points where the added equipment is needed, a lack of system that is uneconomical and which results in a loss of appreciation of the value of the tools by both the section forces and the supervisory officers.

Recently, machine tools, such as tie tampers and other electric and pneumatic tools, have come into general use, and should be included in any discussion of the proper methods of handling small tools. This class of equipment, however, needs to be overhauled periodically by skilled mechanics. The winter season, when these tools are generally idle, furnishes a convenient time for making these repairs without interfering with the seasonal work of the maintenance forces, and the shop in which this is done provides a central point from which a proper distribution can be made for the succeeding season.

As I view the subject, no benefits result from holding surplus tools in section tool houses at any season. It has been my observation that, where this is permitted during the winter, it is almost certain that a surplus will accumulate, even during the working season, and that tool costs will be higher with no ensuing benefits.

Pipe or Box Culvert?

What factors should govern in determining whether a pipe or a box culvert should be used for any given opening?

The Choice Is Not Sharply Defined

By Bridge Engineer

The conditions surrounding the installation of waterways or other openings through embankments are so varied that it is scarcely possible to lay down hard and fast rules for determining the types of structures which shall be used under different conditions. In general, for the smaller openings, as for example a waterway which does not require an area greater than that of a 36-in. pipe, a pipe culvert is the most economical and can be installed most easily. Where the opening re-

quires an area greater than that provided by a pipe 60 in. in diameter, a box culvert is generally more advantageous. These are general statements, however, and the local conditions surrounding the point where the opening is to be installed may be such that the situation is reversed, and the other type of structure is more desirable.

In the interval between the openings represented by the areas of these two sizes of pipe, the advantages of the two types of structures are still less sharply defined. Here the factors which probably will have the most influence in the choice between a pipe and a box culvert are the character of the foundation, the purpose of the opening, the cost of doing the work, the facility with which the installation can be made and the amount of disturbance to traffic which will be necessary.

In placing a new opening through a big embankment or renewing a structure that has failed, a pipe frequently can be installed by tunneling or by jacking the pipe through the embankment. Where either of these methods of installation is feasible, the work can be done with no disturbance to traffic and without the necessity of expensive falsework, thus making a considerable reduction in the cost.

Box culverts are frequently used where the foundations are poor, because an unstable foundation is likely to distort the pipe and cause it to separate at the joints, thus destroying its value. On the other hand, a box can be built to distribute the bearing over a greater area and reduce the unit pressure on the foundation.

In the final analysis, the question of cost will usually be the deciding factor, however, in those cases where either type of structure is suited to the conditions which must be met, although, in many instances, the personal preference of the officer who is responsible for making the decision may govern.

The Primary Consideration Is Cost

By L. C. Stahl
Assistant Engineer, Central of Georgia, Columbus, Ga.

The primary consideration, when selecting a type of construction for small openings, is that of cost, assuming that conditions are such that either a box culvert or a pipe will meet the requirements. Under ordinary conditions a pipe will cost materially less than the ordinary form of box culvert, this difference being approximately 18 per cent for a concrete pipe 68 in. by 74 in.; and 32 per cent for a pipe 54 in. by 59 in., increasing to 44 per cent for standard concrete pipe 30 in. by 33½ in.

Even though the cost may be less, it is not desirable to use pipe larger than the 54-in. by 59-in. size, unless special equipment is available for unloading and placing it, since the weight of a single section of the next larger size, 60 in. by 65 in., is approximately 7,900 lb., while the weight of the largest standard size is more than 15,200 lb. per section. While the unloading and placing of such pipe can be done by hand, provided block and tackle are available, the cost is high and there is considerable danger of damaging the pipe in the process.

If there is the least doubt about the stability of the foundation, the use of a box is preferred, since it requires very little settlement to unjoint a pipe and cause the failure of the culvert. Even though piles may be used in connection with the pipe, the bearing area of the box is so much greater, that its use offers a decided advantage where there is any uncertainty about the character of the foundation. Where an existing culvert has failed, it should be replaced with a box culvert, if the embankment shows any tendency to slide, since here, too, there is serious danger of the joints in a line of pipe opening sufficiently to cause the failure of the structure.

If the culverts are to be installed on a new line or on a diversion which is located at some distance from existing tracks, the box culvert has several advantages, the principal one being that of transportation. Because of their weight, it is very difficult and usually impossible to haul pipe larger than 24 in. by 27 in. When it is physically possible to do so, the cost is generally prohibitive. On the other hand, the transportation of the materials for a concrete box can be handled with ordinary equipment at a relatively small cost. Frequently, suitable aggregates can be secured locally, which simplifies the problem of transportation and reduces the cost of the structures.

A consideration of some importance in filling trestles is the shorter time involved in the installation of culvert pipe and the fact that the fill can be made immediately after the pipe is placed. If a box culvert is constructed, a longer time is required to build it, and after it is completed, a period of approximately four weeks is necessary for it to harden fully before the filling can be started. Offsetting this advantage, however, considerable care must be exercised in making the fill, in order to avoid separating the joints in the pipe, since great expense is sometimes involved in repairing this form of damage, and the temporary cessation of the work is sometimes necessary while this is being done.

Superelevation on Curves

Should the outer rails of curves be elevated for the fastest trains, and if not, how should the proper elevation be determined? What, if any, limit should be set on the amount of superelevation?

Six Inches Should Be the Limit

By J. P. Anderson
Division Engineer, Nashville, Chattanooga & St. Louis, Atlanta, Ga.

Curves should not be elevated for the fastest trains at points where slow freight trains operate, on account of the damage to the inside or low rail by slow trains. If all trains had approximately the same speed around a certain curve, then the proper elevation would be determined by that speed. On the other hand, where fast and slow trains operate, it is necessary to select an elevation which is safe for the fast trains and yet which will not cause more rapid wear on the inside rail than on the outside rail.

For every curve where speeds vary, there is one elevation which will best meet all requirements. The grade and location as well as speed of both passenger and freight trains must be taken into consideration, however.

The proper elevation for any curve should be given careful thought and study, and I believe that no set rule can be made to apply in selecting elevations for curves, as conditions at any two curves are seldom the same.

In locations where the grade and the speed of freight trains are such that the maximum elevation which should be used for fast passenger trains cannot be maintained, the speed of trains should be restricted, by placing proper instructions in bulletins or time tables and by signs erected beside the track.

After giving a curve a certain elevation, the relative wear of the rails should be noted, and if they indicate

too much or too little elevation, then necessary adjustment in the elevation should be made, with due consideration for comfort of passengers, safe movement of trains and economy in track maintenance.

Our sharpest curvature is six degrees and our maximum elevation on any curve is six inches, which in my opinion should be the limit for superelevation.

Speed of Trains Should Be Controlled

By J. MORGAN
Supervisor, Central of Georgia, Leeds, Ala.

In every case the outer rail of a curve must have some elevation, yet it is not always easy to determine the proper elevation for any given curve, particularly on single track, where there is a wide range of train speeds. On my territory, we must provide for speeds up to 55 miles an hour for passenger trains and at the same time expect that, at certain points, the freight trains will be operated at such low speeds as to require scarcely any elevation. The result is that on these curves the inner rail receives considerable abuse from the freight trains, so that it wears more rapidly than the outer rail, but under the conditions which surround these places a better division of the wear does not seem possible.

Curves up to six degrees will carry passenger trains running at a speed of 50 to 60 miles an hour with safety and comfort, if given a superelevation of approximately one inch to the degree. Curves of seven and eight degrees may, under some conditions, be given an added elevation of one inch. This should be the limit, however, and on all curves the speed of the trains should be reduced to conform to these maximum elevations.

Compromise Is Usually Necessary

By G. STAFFORD
Section Foreman, Canadian National, Rosebud, Alta.

Since the centrifugal force acting on a train moving around a curve tends to crowd the wheel flanges against the outer rail, it is necessary to superelevate this rail in order to counteract this tendency, to provide for safe passage of the train and reduce wear on the rail. If all train speeds were equal, the amount of superelevation could be calculated by means of a simple mathematical formula. Since they are not equal, however, some compromise must be found which will permit safe passage of the higher speed trains and, yet, will not interfere with the operation of those of lower speed.

The question of rail wear also enters the problem, because, if insufficient elevation is given, the outer rail will wear excessively, while, conversely, too much elevation causes the inner rail of the curve to wear and the metal in the head to flow, as a result of the greater load thrown upon it. It is clear, therefore, that no hard and fast rule can be laid down, every case being governed by grade, alinement and operating conditions.

My own section is an example of what can be done to make a compromise that will best suit all speeds. The seven miles of single track on this section consist of 58 per cent tangent and 42 per cent curvature, the curves ranging from 1 deg. 30 min. to 7 deg., the entire distance being on a continuous up grade toward the west. In order to determine whether the elevation which had been established was the best to meet the operating conditions, the gage side of a number of rails on typical curves was marked with chalk, so that the location of the greatest pressure was indicated by the total or partial obliteration of the chalk marks. Notes were made of the elevation and the points where the pressure, as indicated, was comparatively light, and the elevation was adjusted until the chalk marks indicated a relatively even pressure on both rails.

While, in this territory, the Canadian National places a limit of six inches on the superelevation, it is my opinion that eight inches can be allowed under some circumstances, although in general, where excessive elevation is required, the speed of trains should be reduced to correspond to a smaller superelevation, since the maximum theoretical elevation is suitable for only a few trains, and at lower speeds considerable discomfort may be experienceed. Another consideration is that of economy. Too much or too little elevation causes rapid wear of the rails, results in poor gage and defective surface and alinement, and may be the direct cause of early failure of the ties as a result of rail renewal and gaging.

Interior Walls of Small Stations

What are the relative merits of plaster and wood ceilings for the interior walls of small stations?

Wood Ceiling Should Never Be Used

By BUILDING INSPECTOR

There is little justification at present for the use of wood ceiling in new construction, although there may be some advantages in continuing to use it in small stations already finished in this manner. Wood ceiling usually becomes soiled and stained with age, so that no amount of cleaning or painting will give it a pleasing appearance. It is frequently placed before the wood is fully seasoned, and where this is done, it is inevitable that shrinkage will occur, with the result that cracks open, thus adding to its poor appearance and increasing the opportunities for catching and holding dirt.

Where this form of finish has been installed, and it is desired to give the interior of the building a better appearance, it is often possible to leave the ceiling undisturbed, placing over it one of the several brands of wall board or plaster board which are available. By a skillful use of paneling, pleasing results can be obtained and the appearance of the room entirely changed. One of the advantages of doing this is that most forms of wall board have considerable insulating value, so that the room is made warmer in the winter and more comfortable during hot weather. Another advantage is that the walls can be more easily painted, and the painted surface looks better than that of the ordinary forms of ceiling.

New buildings should be either plastered or finished with wall board, since these materials are more sanitary and, as already mentioned, give a better appearance while their use permits, by simple means, a great variety of plain but pleasing wall designs.

Plaster Is Preferred

By A. L. SPARKS
Architect, Missouri-Kansas-Texas, St. Louis, Mo.

The more or less common practice of covering the interior walls and ceilings of station buildings with matched and beaded wood ceiling is one that has probably outlived its age. In years past, when good lumber was plentiful and when railway lines were being extended so rapidly that it was almost necessary to construct station buildings over night, in order to meet exacting obligations, pine ceiling filled a pressing need.

A house gang could haul all of the necessary equipment and material for a station on the outfit train, and

complete the building without the delay incident to waiting for shipments of sand and cement, and also without waiting for the plaster to dry; all of which resulted in considerable saving when time was at a premium.

For small stations that serve a temporary need in a rapidly growing community, and which may be moved later to some other location, wood ceiling is still commendable, for the reason that it makes a little better bracing than plaster, while the plaster is sometimes cracked or damaged in moving.

It is seldom necessary in these days to construct stations in such great haste, and since plaster can be provided for about the same cost as 1-in. by 6-in. ceiling, and as there are so many other points in its favor, the wood ceiling is seldom justified.

Plaster presents a cleaner and more sanitary surface, with the absence of joints and cracks in which dust and soot collect. It also makes a better insulation against heat and cold, is more fireproof and more easily painted.

Substitutes for plaster and ceiling are easily obtained from stock in the different composition boards, which come in varying thicknesses and in sheets of large size. This type of material is rapidly taking the place of wood ceiling, as it can be installed at less expense and can be made to present a more pleasing appearance. Where this type of construction is followed, the lower portions of the wall may be wainscoted with car siding, to provide a more rigid surface over the area which is subject to rough usage.

Bridge Work in Winter

To what extent can ordinary bridge maintenance be carried on during the winter? What are the relative advantages and disadvantages of doing the various classes of bridge work at this season?

Keeps Trained Men in Service

By Assistant Engineer of Maintenance

Ordinary bridge work cannot be carried on quite as effectively in winter as in summer. Ice, snow and sleet impede progress and men are somewhat hampered in their movements by heavy clothing. However, these disadvantages are offset by the benefit derived in providing continuous occupation for bridge crews. By thus affording steady employment, a better class of men can be obtained and retained to form trained nuclei for the larger crews necessary in more favorable weather. Then, too, these bridge crews of trained men working during the winter are available for use in emergencies which may arise.

Much Bridge Work Can Be Done in Winter

By A. B. Scowden

General Bridge Inspector, Baltimore & Ohio, Cincinnati, O.

During the months of January, February and March, considerable bridge maintenance work cannot be handled to advantage because of the low temperatures. In addition, we are also frequently handicapped by high water during January and February, and extreme high water during March and April, these latter being the two months of our regular spring floods. In scheduling the work which can be handled advantageously during the winter we must, therefore, exclude such items where high water or low temperatures would seriously interfere with the progress of the work.

On the other hand, it is a distinct advantage to carry as much of the regular force as possible during the winter. The men who are laid off in the fall as a rule are not available again when the season opens up in the spring, and it is necessary to hire new and inexperienced men who will work with much less efficiency.

The most important work, which is always scheduled for winter handling, consists of replacements and repairs to shipping docks, coal unloaders, ore handling machines and other equipment along the Great Lakes which, with the closing of navigation for the winter, can be taken out of service and repaired without interrupting operation.

The most important work, which can be handled with nearly equal facility, both in winter and summer, and which, therefore, is given preference, as far as possible, for winter scheduling comprises:

Steel work, consisting of replacing members in steel structures, and redriving rivets which have become loose or are ineffective owing to corrosion of heads. During the winter extra air equipment is usually available to facilitate this work.

Trestle construction—all renewals or repairs to timber trestles can be handled equally well in winter, and this work is given preference for winter scheduling, except at locations where the ground may be inundated frequently during the winter months.

It is also considered advantageous to handle mass concrete construction during the winter months, where weather protection during the placing and curing can be provided in a simple manner and at small cost in proportion to the yardage involved.

Work which is avoided in the winter schedule and transferred to the summer schedule consists of:

Painting steel structures (outside exposures).

Concrete work involving thin sections, where winter protection would be expensive.

Pointing and patching stone masonry.

Jacking culverts through embankments, since better arching action is secured when the earth is dry.

Any work which is dependent on low water stages for successful handling.

Pocket Gophers and Muskrats

What is the best method of preventing pocket gophers and muskrats from burrowing in roadway embankments?

Eradication Is Best Form of Control

By General Roadmaster

The damage caused to track by pocket gophers may be considerably greater than can be appreciated by any one who has not been compelled to deal with the results of their efforts. For some reason, in certain localities, these animals seem to prefer to burrow in railway embankments rather than elsewhere. In any event, where they are plentiful they may become a serious menace to the safety of the track, unless they are properly controlled.

Little can be done toward minimizing the damage they do, unless a program of complete eradication is undertaken. In sections where the infestation extends over a wide area, as it sometimes does, such a campaign may be difficult, or even impossible, to carry through unless the complete co-operation of the citizens of the community or of the local and state governments or all of these agencies is enlisted and maintained until the eradication is complete.

The United States Bureau of Agriculture has made extensive studies of the best methods of eradicating these and other similar pests, and its representatives will

advise as to the methods best suited to any particular locality. So far as the writer knows, there are no methods by which these animals can be prevented from burrowing in embankments so long as they are allowed to infest any area. But, certainly, where any number of them occur, complete eradication would seem to be worth trying.

Control Pocket Gophers with Poison

By R. S. KNIFFEN
General Roadmaster, Great Northern, St. Paul, Minn.

Pocket gophers and other similar rodents prefer to work under cover rather than in the open. For this reason, wherever we find any territory is being infested by pocket gophers it is our practice to keep the embankment free from brush and weeds. This practice has another advantage, however, because it enables us to discover immediately any efforts they may make to burrow in the embankment and are enabled to take such measures as may be desired to get rid of them.

Our experience indicates that the only method of preventing these animals from burrowing in the embankment is to destroy them. To do this, we place poisoned oats or corn in their burrows and in some cases we have used a proprietary article which, when introduced into the burrows, forms a gas which suffocates the animals. We also think that the most desirable time to use the various kinds of poison is in the spring, early enough to kill as many as possible before they start to multiply.

Muskrats Can Be Controlled

By DIVISION ENGINEER

The muskrat is an aquatic animal which feeds on the roots and stems of aquatic plants, so that it is seldom, if ever, found in numbers away from marshy ground or still, shallow water. One of its favorite resorts along the railways is undrained borrow pits. In such locations, where drainage can be accomplished, this will usually give complete relief from the trouble which these animals cause.

Muskrats are extremely prolific and, where they get a foothold, they multiply rapidly, so that within a year or two after they first appear they may constitute a serious menace to the stability of the embankment. It is one of their characteristics that the entrance to their burrows is made slightly below the surface of the water, so that the damage they are doing often is not appreciated until it has progressed to the danger point.

During the fall months these animals build large houses in the swamps or even in shallow water, constructing them well above the water out of reeds and grasses, using them for the purpose of hibernating during the winter. The economic value of the muskrat is very great, since muskrat fur constitutes a large part of the total annual fur catch of North America. Because of this habit of hibernating, they can be taken quite easily during the winter season, by simply opening their houses. Also, because of the value of the fur, it is not difficult to persuade trappers to hunt them during the winter when the fur is prime, and thus make a material reduction in their numbers.

While this is a simple and easy method of control, it seldom results in complete eradication, so that, where they are causing trouble other methods must be applied. One reason why they burrow so industriously in railway embankments is that the edges of swamps or borrow pits seldom rise much above the water level. While the entrance to the muskrat burrow is below the surface of the water, the large galleries which they construct are always sufficiently above the water surface to insure that they will be dry. In many cases, the embankment furnishes the only convenient place where they can get far enough above the water to construct the roomy galleries which they prefer.

They seldom burrow in sand or other loose material because of its instability. For this reason, a heavy application of sand or locomotive cinders is often sufficient to stop them. Where this does not bring results, bank-run furnace slag has been found quite successful since they are unable to work through it. The application of any of these materials should be heavy, however, in order to secure complete relief. In one instance with which the writer is familiar, cinders were tried without success. As sand probably would have been no better in this case, and as no slag was available, a rip-rap wall of one-man stone was hand laid with close joints and all openings chinked. By this means complete relief was obtained from a really serious condition which had existed for several years.

Tank Spouts and Water Columns

What are the relative advantages of tank spouts and water columns, and under what conditions can each be used most satisfactorily?

Many Advantages in Favor of Water Columns

By WATER SERVICE ENGINEER

Tank spouts should never be used on busy main lines and their use on less important lines should be limited to those cases where only a few trains a day are operated. In the North, where winter conditions are severe, I would eliminate them altogether.

Numerous cases are on record where failure of the tank valve to close has drained the tank, and in some instances the flow of water has washed out the track, thus endangering trains. If the counterweight mechanism becomes inoperative, the spout may assume a position which will endanger trainmen, and the writer knows of two or three cases of injury from this cause. During the winter it is not unusual for sufficient ice to accumulate on the chains to prevent the operation of the spout.

It is not possible to adjust a tank spout so that it will serve properly all heights of engine tanks, so that considerable water is wasted where tanks of varying heights are operated regularly. In the winter, this waste water causes a rapid accumulation of ice which must be kept cleared away, usually by the section forces, and frequently at a time when their services are demanded elsewhere. While these are not all of the disadvantages of tank spouts, the single item of the danger of personal injury which accompanies their use is sufficient to condemn them.

On multiple track lines, water columns are a necessity, since a single tank can rarely be so located that it will serve more than one track. In making a comparison of the relative advantages of tank spouts and water columns the discussion should, therefore, be confined to the delivery of water to a single track line. Under normal conditions the valve of a water column is positive in its action, and few failures occur which cause excessive leakage. Where the flexible spout is used, water can be taken by engines having any height of tank with a minimum waste of water. If proper precautions are taken against freezing, the water column does not become inoperative, even in the severest winter weather.

In addition to a smaller waste of water, drainage

from a water column is comparatively easy, so that track conditions are better, especially during the winter months.

While water columns, as a general rule, cost more to install than tank spouts, the cost of maintenance throughout the year may, under many conditions, be no greater than is required for the tank spouts. The advantages of the water columns are obvious, particularly for those locations where severe winter conditions prevail. In addition to their superiority from operating and maintenance standpoints, their use frequently permits the location of the service tank at some distance from the track, a decided advantage where later track changes may require the removal of the tank if located adjacent to the main tracks.

Does Not Favor Water Columns

By H. L. GRAHAM

Foreman of Water Service, Georgia Railroad, Union Point, Ga.

As a result of an extended experience in water service, I would not think of using a water column where it is possible to use a tank spout. The ability to use a tank spout depends, however, on the track layout and the amount of room available for locating the water tank. On a multiple track line, or where it is necessary to take water from both the main line and a passing siding, it seldom occurs that the tracks can be spread a sufficient amount to permit the installation of a service tank between them. In such cases, the recourse must be to water columns, whether carried on a standard of the usual form or suspended from an overhead bridge. Under ordinary conditions, however, the tank spout is, as I believe, much more desirable than a water column.

About three years ago I had occasion to install facilities for watering locomotives at a point about 60 ft. removed from the service tank. The installation of a water column would have involved a heavy expense, since an outlet for drainage could not have been obtained closer than 1,200 ft. from the point of delivery. As a substitute, I erected a frame made up of three second-hand 56-lb. rails and suspended a tank spout from this frame. The water was brought underground through a pipe line, and a riser with the usual form of tank delivery pipe was installed to serve the spout. The valve and lifting device are located in the tank and are operated from the point of delivery by means of an overhead cable. This installation, which cost only a fraction of what a water column and the necessary drainage would have cost, has been in service for more than three years and has given complete satisfaction.

Inspection of Buildings

A further answer to the following question which was discussed in the September issue:

What details should be given particular attention in the inspection of buildings?

Thorough Inspections Should Be Made Periodically

By A. L. SPARKS

Architect, Missouri-Kansas-Texas Lines, St. Louis, Mo.

Periodical inspections of buildings should be sufficiently thorough to discover all defects which may exist, particular efforts being directed to locate any that may not be readily apparent, and to develop the source of trouble, in order that necessary steps may be taken to correct the cause before irreparable damage results, or damage that will necessitate unreasonable maintenance expense.

It has often been said that a building with a good foundation and a good roof will last forever, and there is a close approximation to the truth in this statement. First of all, the foundations should be observed. If any cracks have developed in either the foundation or the building superstructure, the cause should be ascertained.

Leaky or broken downspouts as well as clogged drains cause a large percentage of building foundation troubles, since they tend to cause softening of the earth under the footings.

Sagging and binding of the waiting room doors may indicate settlement of the foundation which has not yet progressed sufficiently to give any other indications. This defect may be due to a slight local settlement of the foundation which is sometimes caused by a low or broken place in the depot platform, which holds water long enough to cause saturation of the earth under the footings.

It is important that chimneys be examined carefully with a view to observing any cracks that may cause a fire hazard. Defective chimneys are a menace to any building and a fertile source of destructive fires, since a fire starting from this cause frequently gains considerable headway before it is discovered.

Roofs should be inspected, and flat roofs should be cleared of all foreign substances that may clog the down spouts or puncture the roofing if they are stepped on. Leaks in roofs are sometimes neglected for the reason that they cause no one any particular discomfort. Such leaks are often expensive if they are allowed to continue until the sheathing or rafters are decayed, however, and they should be corrected as soon as found to avoid the expense of unnecessary repairs later. The gutters should also be examined to determine whether the roof drainage is free. It is more important from a maintenance standpoint that gutters be painted inside than outside.

Windows should be examined to determine their condition, particular attention being required to determine whether they are weather-tight, whether the glass is well puttied and all window panes are in place, and whether the window hardware and sash cords are in good condition. Likewise the inspection should include the doors, and their hardware. The hinges should be tight and work smoothly; the locks should be in operative condition and the latches should hold the door shut; all door knobs and latch lifts should be in place and operate easily; while kick plates and bars should be in place and straight. It should be noticed particularly whether door checks are functioning properly.

While the building inspector usually is not directly responsible for the maintenance of the heating, lighting or plumbing facilities, he should make a sufficient inspection of each to know that they are functioning and have no obvious defects.

Finally, the exterior and interior painting of the building should be observed. Many buildings, particularly stations and offices, need to be repainted for the sake of appearance, even where the protective value of the paint has not been impaired. The appearance of these buildings forms the basis for the judgment of the railway by a considerable portion of the public, and such a small matter as the condition of the paint on a station may result in a favorable or unfavorable sentiment in a community.

WITH THE ASSOCIATIONS

The Tie Producers Association

The National Association of Railroad Tie Producers will hold its twelfth annual convention at the Peabody Hotel, Memphis, Tenn., on April 29, 30 and May 1, 1930.

Metropolitan Track Supervisors' Club

The October meeting of the Metropolitan Track Supervisors' Club of New York City, was held on Friday, October 18, at Keen's Chop House, with 58 members in attendance. The meeting was addressed by C. C. Cook, maintenance engineer of the Baltimore & Ohio, who presented a paper on "Economies in the Use of Materials," prepared by Earl Stimson, chief engineer maintenance of the Baltimore & Ohio, who was unable to attend. The next meeting of the club will be held on December 12, at Keen's Chop House, 72 West Thirty-Sixth street, New York, at 12:30 p. m.

Maintenance of Way Club of Chicago

The ninth annual meeting of the Maintenance of Way Club of Chicago was held at the Auditorium hotel on Tuesday evening, October 22. The speaker of the evening was W. E. Fuller, assistant to the executive vice-president of the Chicago, Burlington & Quincy, whose subject was "The Roadmaster in His Relations With the Superintendent."

The following officers were elected for the ensuing year: President, R. N. Wade, engineer maintenance of way, Chicago Rapid Transit, Chicago; first vice-president, J. de N. Macomb, assistant to vice-president, Inland Steel Company, Chicago; second vice-president, J. P. Corcoran, roadmaster, Chicago & Alton, Bloomington, Ill.; secretary-treasurer, W. S. Lacher (re-elected), managing editor, *Railway Engineering and Maintenance*, Chicago. The report of the secretary-treasurer showed that the club has 276 members in good standing, an increase of 59 as compared with a year ago.

The Wood-Preservers' Association

Plans for the twenty-sixth annual convention, which will be held at Seattle, Wash., on January 28-30, 1930 are rapidly assuming form. If a sufficient number of members from the east indicate their intention of attending the convention a special train will be provided by the Chicago, Burlington & Quincy and the Union Pacific, leaving Chicago at 8:30 on Thursday morning, January 23, and stopping enroute at the Galesburg, Ill., timber treating plant of the Burlington and at the Laramie, Wyo., Pocatello, Idaho, and The Dalles, Ore., plants of the Union Pacific to enable the members to study the methods employed in these plants for the treatment of timber by various processes. The train will arrive at Portland at 1:30 p. m., Sunday, January 26, and Monday will be spent at the Long Bell and Weyerhauser mill and logging operations at Longview, Wash. The party will arrive at Seattle on Monday evening. During the convention an inspection will be made of the treated timber in the structures on the Seattle water front while on Friday, following the adjournment of the convention, the party will be taken to Victoria, B. C., by steamer.

American Railway Engineering Association

The past month has been characterized by unusual activity among the committees in their efforts to complete their reports for submission to Secretary Fritch for publication. Fifteen of the committees held meetings during the month as follows: The Committee on Iron and Steel Structures held a two-day meeting at Washington, D. C., on October 3-4 with 20 members present. The Committee on Ballast met at Pittsburgh, Pa., on October 5 with 8 members present. The Committee on Water Service and Sanitation met in Chicago on October 8 with 26 present. On October 10 the Committee on Rail met in New York with 25 present, while on October 10-11 the Committee on Uniform General Contract Forms met in Boston, Mass., with 10 present. Fourteen members of the Committee on Wood Preservation attended a meeting in Chicago on October 15. The Roadway Committee met at the same place on the same day, while the Committee on Rivers and Harbors met in New York on the same day with seven present. The Committee on Wooden Bridges and Trestles met in Chicago on October 18 with 12 present, while the Committee on Signals and Interlocking met in the same city on October 22. The committees on Buildings and on Records and Accounts met at New York and Washington, D. C., respectively, on October 24-25, while the Committee on Rules and Organization met in Chicago on the latter day. The Committee on Economics of Railway Labor met at Chicago on October 28, with 19 present, while the Committee on Ballast met in the same city on October 31.

Four committees have completed their reports and turned them in to Secretary Fritch for publication, including the committees on Standardization, Water Service and Sanitation, Wood Preservation, and Grade Crossings.

Secretary E. H. Fritch arrived at Tokyo, Japan, on October 13, where he, together with President Yager, will attend the World Engineering Congress from October 29 to November 7, as representatives of the association. Secretary Fritch will sail from Yokohama on November 23, and is expected back in his office on December 4.

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of August			Eight months ending with August		
	1929	1928	Increase 1929 Over 1928, per cent	1929	1928	Increase 1929 Over 1928, per cent
Railway Operating Revenues	586,563,357	558,751,499	5.0	4,208,393,408	3,984,931,742	5.6
Expenditures for maintenance of way and structures	**82,796,501**	**77,036,359**	**7.5**	**577,990,196**	**564,045,690**	**2.5**
Total Operating Expenses	395,686,102	384,527,744	2.9	3,031,026,515	2,970,127,580	2.1
Net Railway Operating Income	141,436,097	128,435,626	10.1	827,734,976	686,081,631	20.6

RAILWAY NEWS BRIEFLY TOLD

During a recent safety-first contest on the Southern 5 divisions and 16 shops, comprising 21 of the 47 units of the railway, went through the month of August without a reportable injury.

The first round trip over the completely ballasted extension to Fort Churchill on the Hudson Bay Railway was completed on September 18. The officers who made the journey report the line in good condition and now available for passenger traffic.

The Canadian National, during the period from June 15 to September 15, completed and turned over to its operating department more than 365 miles of new branch lines in Western Canada. On September 6 there were 370 additional miles of branch lines under construction, on which 111 miles of rail had been laid.

A freight train of 150 cars was run by the Pennsylvania from Altoona, Pa., to Morrisville, 259 miles, on September 12, without any break in the train, in 18 hours and 5 minutes. This train traversed the 130 miles of the Middle division in 6 hours, with an average speed of 22 miles per hour.

After 25 years of experimental use, the application of roller bearings to railway equipment has now developed to the point that 1,444 cars and 475 locomotives, including a few gas-electric units, are now equipped with this type of bearings, some of which have been in regular service for about five years. In addition, 135 cars on electric lines have been similarly equipped.

The United States District Court at Los Angeles, on October 1, denied the joint plea of the Atchison, Topeka & Santa Fe and the Southern Pacific for a temporary injunction restraining the state of Arizona from enforcing its law, which limits the length of passenger trains in that state to 14 cars and freight trains to 70 cars, exclusive of the caboose. A motion by K. Berry Peterson, attorney general of Arizona, on behalf of the state for dismissal of the railroad's case, was taken under consideration by the court.

The Gulf, Mobile & Northern has acquired control of the New Orleans Great Northern thus creating a new railway system of 1,000 miles with port outlets at Mobile and New Orleans. Under a trackage agreement with these two lines, the Chicago, Burlington & Quincy has used New Orleans as an export terminal for grain shipments for more than a year, the route from the end of the Burlington tracks comprising the Nashville, Chattanooga & St. Louis from Paducah, Ky., to Jackson, Tenn., thence the Gulf, Mobile & Northern to Jackson, Miss., and the New Orleans Great Northern from this point to New Orleans.

Officers and employees of the Canadian National are to be given the opportunity to buy a portion of a $30,000,000 bond issue of that company. A total of $5,000,000 of 40-year five per cent gold bonds, dated October 1, 1929, have been set aside for officer-employee purchase.

The Great Northern has recently provided its stores, maintenance of way and mechanical departments with more than 60 automobiles and highway trucks, representing an investment of approximately $100,000, to be used in their daily work. This company estimates that this equipment is saving its cost every year as a result of economies effected in handling materials and in maintenance operations. Records show that each truck is in service for more than 22 days every month, and travels approximately 1,000 miles in the same period. The combined savings of 13 trucks, used at various points, amounts to $3,800 a month, or approximately $45,000 a year.

Louis W. Hill, formerly president of the Great Northern, retired as chairman of the board of that railway on October 10. At the same time, he was re-elected a member of the board of directors and a member of the executive committee. The retirement of Mr. Hill marks the end of a continuous period of 46 years during which James J. Hill and his son were in executive direction of the Great Northern and its predecessor companies, either as president or chairman of the board. If the service of James J. Hill as general manager of the St. Paul & Pacific and vice-president and general manager of the St. Paul, Minneapolis & Manitoba is included, this period is increased to more than half a century.

Some Records

In the first 41 weeks of 1929 42,237,641 cars were loaded on the railroads of the United States, as compared with 41,395,755 in the corresponding period of 1927, previous high record for this period. Measured in ton miles, the freight traffic for the first eight months of 1929 totaled 325,388,114,000, an increase of 11,030,634,000, or 3½ per cent over the corresponding period in 1927.

The average speed of freight trains in August of this year was 13.1 miles per hour, the highest average ever reached in that month. The daily average movement per freight car in August was 33.5 miles, which exceeds the previous high average for that month, established in August, 1928, by 1.4 miles.

Seven additional twenty-hour trains between New York and Chicago, making a total of nine, were placed in service by the New York Central on September 29. On the same date the Pennsylvania added four twenty-hour trains to its service between these cities, so that it now operates six trains on this schedule. One of the New York Central trains is named the "Commodore Vanderbilt," which is said to be the first train ever named after an individual. The Pennsylvania has designated one of its new trains the "Golden Arrow." In addition to this twenty-hour service, both roads have shortened other schedules, so that the Pennsylvania also has six other trains and the New York Central seven which make the run between these cities in 20 hours and 50 minutes.

The Old Portage Railroad, which formerly extended over the summit of the Allegheny mountains between Hollidaysburg, Pa., and Johnstown, was the object of a celebration near Cresson, Pa., on October 1, commemorating the opening of this road on March 18, 1834. This road, which was 37 miles long, was an important link in the early system of canals and railways which connected Pittsburgh and Philadelphia, and derived its name from the fact that it was a portage between the termini of two canals. The road attained the summit by a series of five levels and five inclined planes on each side of the summit, which was 2,326 ft. above sea level. The inclined planes ranged in length from 1,480 to 3,116 ft. and the several elevations, which were overcome, ranged from 130 ft. to 370 ft. The longest level was slightly more than 13 miles in length. Trucks were drawn up and lowered down the inclines by means of hempen cables 7 in. in circumference, which ranged in length from 3,616 ft. to 6,662 ft., power being furnished by 12 stationary engines. Twelve teams of horses and nine locomotives were also used in pulling the trucks over the level sections.

Construction News

The Atchison, Topeka & Santa Fe, through subsidiaries, has filed three related applications with the Interstate Commerce Commission for the construction of approximately 380 miles of new lines in Texas, Oklahoma, New Mexico and Colorado, which will afford a shorter line between Colorado and the Gulf of Mexico, and a shorter line between Los Angeles and Chicago, and will also serve local agricultural territory and an oil and gas field in the Panhandle of Texas, heretofore without transportation facilities. The Dodge City & Cimarron Valley has applied for a certificate authorizing the construction of a line from the south line of Baca county, Colo., to Las Animas, Colo., 83 miles; the Panhandle & Santa Fe has asked authority for a line from Amarillo, Tex., to a point on the north line of Dallam county, 98 miles, with a branch from Dumas, Tex., to Spearman, 50 miles; the Elkhart & Santa Fe has asked authority for an extension of 39 miles in Cimarron county, Okla., and a line from Felt, Okla., to Colmor, 110 miles.

The Canadian National has awarded a contract to Harold N. Price, Moncton, N. B., for the construction of a branch line on Prince Edward Island from Lake Verde Junction to a point near Pisquid, about 10 miles. A contract for the construction of a 67-mile branch from Sunny Brae to Guysborough, N. S., has been awarded to the Dominion Construction Company, Toronto, Ont. The cost of this branch will be approximately $3,500,000.

The Canadian Pacific has received bids for the construction of a second main track from Sudbury, Ont., to Azilda, 7.3 miles. When completed, this will give a continuous double-track for 44 miles from Romford, 6.6 miles east of Sudbury, to Geneva, 37.4 miles west thereof.

This company has awarded a contract to the Dominion Construction Company, Toronto, Ont., for the construction of a six-mile branch line near Chelmsford, Ont., at a cost of $150,000. A contract has also been awarded to the Sidney E. Junkins Company, Ltd., Vancouver, B. C., and the P. M. Smith Construction Company for the construction of concrete piers and the encasement of existing piers of various bridges on the main line between Vancouver, B. C., and Kamloops.

The Chicago & North Western has let contracts for the construction of 15 miles of third main track between Des Plaines, Ill., and Barrington, involving a total cost of $1,400,000. A contract for the excavation of 190,000 cu. yd. of earth has been awarded to Roberts Brothers, Chicago, and the contract for extending the bridges has been let to Peppard & Burrill, Minneapolis, Minn. This company has also reached an agreement with the city of Chicago for the elevation of its tracks on the Wisconsin division from Foster avenue north to the city limits, about 2.5 miles, at an estimated cost of $4,000,000.

The Chicago, Burlington & Quincy has authorized the construction of a new classification yard of 10,000-cars capacity, at Galesburg, Ill., consisting of eastbound and westbound humps, equipped with retarders, and two classification yards of 29 tracks each. This project involves the rearrangement of the present locomotive terminal at Galesburg and will cost approximately $5,000,000. This road has also let contracts totaling $825,000 as follows: To V. R. Gould, Omaha, Neb., for the rearrangement and construction of an addition to its passenger station at Omaha, $700,000; and to G. A. Johnson, Chicago, for the construction of an addition to the enginehouse at Western avenue, Chicago, $125,000. This company plans the construction of approximately five miles of fourth main track between Aurora, Ill., and Eola.

The Chicago, Rock Island & Gulf, a subsidiary of the Chicago, Rock Island & Pacific, has applied to the Interstate Commerce Commission for authority to construct 58.14 miles of line from Dalhart, Tex., to Morse.

The Great Pacific of Mexico has obtained concessions from the Mexican government through J. E. Coss, H. O. Zwarg and C. M. Blanco of Mexico, D. F., for the construction of 902 miles of lines, within the next 12 years, in Oaxaca, Guerrero and Michoacan, Mexico. Construction on the three concessions will be started as soon as the survey and location plans have been finished and approved by the Department of Communications and Public Works of Mexico. The first section of the proposed railway, known as the Blanco-Coss concession, includes the construction of a line from Ejutla, Oax., a terminus of the National of Mexico, to Puerto Angel, a port on the Pacific Ocean, 75 miles, with a line along the cost from Pochutla, a point near Puerto Angel, to Salina Cruz, about 93 miles. The Zwarg concession involves the construction of a line from Puerto Angel, along the Pacific Coast westward to Acapulco, Gro., 249 miles. The Mexican Pacific Company concession covers the construction of a railway west and north from Acapulco to Uruapan, Micho., 267 miles, with a line branching from Las Balsas, Gro.

Rail Orders Break Early Records

Within recent weeks 17 of the largest roads have ordered more than one million tons of rails for their 1930 requirements. In other words, the mills already have on their books nearly one-half of next year's normal rail tonnage. The largest order is one for 310,000 tons which has been placed by the Pennsylvania and is said to be the largest single purchase of steel rails ever made, involving the expenditure, with fastenings, of $21,000,000. The next in order of magnitude is that of the New York Central for 206,430 tons. Other large orders include those of the Santa Fe for 87,500 tons, the L. & N. for 59,900 tons, the C. & O. for 53,480 tons, the C. M. St. P. & P. and the M. P. for 50,000 tons each and the U. P. for 48,000 tons. These orders not only indicate the increasing trend towards winter rail laying but also indicate that next year's improvement program will be an active one.

The Long Island has awarded a contract to Foley Brothers, Inc., Pittsburgh, Pa., for the elimination of six grade crossings at Jamaica, N. Y., at a cost of $2,473,162. Structural steel, retaining walls and water proofing, are included in this contract.

The New York Central has prepared plans for the construction of a highway subway under its tracks east of Delta, Ohio, to cost approximately $214,000. Contracts for other work have been awarded as follows: To the Poirer & McLane Corporation, New York, for the reconstruction of bridge J-13 at Weehawken, N. J.; to the M. F. Kelly Building Corporation, New York, for the construction of a passenger station at Tremont, N. Y.; to the Bates & Rogers Construction Company, Inc., New York, for the elimination of the Orden Avenue grade crossing at Forks, N. Y.; to the Robbins-Riply Company, New York, for the construction of the substructure, deck and trestle for additions to Pier K, Weehawken, N. J.; and to H. R. Beebe, Inc., Utica, N. Y., for the elimination of the grade crossing of the Durhamville-Rome highway at Rome, N. Y.

The Northern Pacific has filed an amended application with the Interstate Commerce Commission for authority to construct an extension from Brockway, Mont., to Lewistown, 208 miles, stating that arrangements have been made with the Chicago, Milwaukee, St. Paul & Pacific for trackage rights over its line from Winnett, Mont., to Lewiston, 51 miles.

The Pennsylvania has awarded a contract to Gibbs & Hill, Inc., New York, for the erection of the catenary system between Millstone Jct. and Sunnyside yard, on Long Island, and Jersey City, N. J., in connection with the electrification of the main line from New York to Philadelphia. The cost of the work to be done under this contract totals $5,340,000. A second contract has been let to Gibbs & Hill, Inc., for the construction of the distribution and transmission systems between New York and New Brunswick, N. J.

Other contracts of importance have been awarded as follows: To the

Stillman-Delehanty-Ferris Company of Jersey City, N. J., for the construction of new transfer bridge foundations and racks and the reconstruction of the stockyards pier at Jersey City, N. J., at a total cost of $780,000; to the Philip Carey Company, Newark, N. J., for waterproofing a concrete deck bridge, used jointly by the Pennsylvania and the Lehigh Valley over Newark bay at Newark, at a cost of approximately $30,000; to the Crossan Construction Company of Brownsville, Pa., for the construction of a new passenger station at Coshocton, Ohio, $25,000; to Steele & Condict, Inc., Jersey City, N. J., for the construction of two new transfer bridges in connection with the terminal improvements now under way at Jersey City, at an estimated cost of $273,000; to the P. J. Foley Company of Pittsburgh, Pa., for the construction of a bridge over Bowen road, Elma, N. Y., at a cost of $75,000; to the Robert E. Lamb Company of Philadelphia, Pa., for the construction of an addition to the inbound freight house at Harrisburg, Pa., at an estimated cost of $97,000; to the General Construction Company of Gary, Ind., for a new brick passenger station with necessary facilities at Gary, Ind.; to J. Rich Steers, Inc., New York, for the construction of foundations for a bridge over the Passaic river at Newark to cost $695,000; and to the P. J. Foley Company for the construction of a subway at James street, Newport, Dela., to cost $65,000.

The Southern (Cincinnati, New Orleans & Texas Pacific) has let a contract to the Bates & Rogers Construction Company, Chicago, for the construction of nine miles of second main track between Blanchet, Ky., and Sadieville.

The Union Pacific has let contracts to H. A. Baum, Los Angeles, Cal., for the construction of an addition to the roundhouse at Cheyenne, Wyo., at a cost of about $300,000 and for the remodeling of the passenger station at the same point at a cost of approximately $70,000. A contract for changing the channel of Bitter Creek at Green River, Wyo., and the construction of an addition to the yard at the same place, at a cost of approximately $170,000, has been awarded to the Utah Construction Company, Salt Lake City.

The Virginian has awarded a contract to Boxley Brothers Company, Inc., Orange, Va., for the grading of seven miles of new line from Elmore, W. Va., westward to a connection with the Chesapeake & Ohio at Gilbert, at an estimated cost of $500,000.

The Wyoming-Montana placed before the Interstate Commerce Commission, on October 3, an application for authority to acquire and construct 602 miles of railroad from Miles City, Mont., to Craig, Colo., where it is proposed to make a connection with the Denver & Salt Lake for operation over the tracks of the latter to Denver, Colo.

Supply Trade News

General

The American Chain Company, Inc., has moved its Chicago offices to Room 1765, Chicago Daily News building.

The Central Alloy Steel Corporation, Massillon, Ohio, has acquired the entire property, assets and business of the **Interstate Iron & Steel Company,** Chicago. This company has authorized an expenditure of more than $600,000 for improvements at its plants in Massillon, Ohio, and Canton. At Massillon, the entire sheet rolling mill plant will be equipped with continuous pack and pair furnaces and electric drive equipment will be installed; at Canton a normalizing furnace 108 in. wide and 100 ft. long is to be constructed.

Personal

C. H. MacDonald, director of sales and head of the market research department of the **Colorado Fuel & Iron Company,** Denver, Colo., has been elected vice-president.

J. C. Taylor, Jr., has been appointed vice-president in charge of sales of the **Taylor-Wharton Iron & Steel Company,** Highbridge, N. J.

M. E. Danford, works manager of the Middletown division of the **American Rolling Mill Company,** Middletown, Ohio, has been promoted to assistant vice-president.

Ross M. Blackburn, representative of the Buda Company, Harvey, Ill., has been promoted to district sales manager of the Chicago territory, with headquarters in the Railway Exchange building, Chicago.

A. Verne Jackson, formerly chief engineer of the **K. & W. Equipment Company,** Chicago, has been appointed district sales manager of the **Buda Company** in the Michigan, Indiana and Ohio territories, automotive division.

James H. Watters, who has been elected president and general manager of the **Marion Steam Shovel Company,** was born on January 30, 1885, at Norfolk, Va., and was educated at the University of Virginia. On January 1, 1926, he entered the employ of the New York Air Brake Company, New York, as vice-president and manager of sales, which position he held until his recent election as president of the Marion Steam Shovel Company.

D. H. Corlette, who has been in charge of investigation and research for the **Wood Conversion Company,** Cloquet, Minn., has been promoted to manager of railroad and industrial sales, a newly created position, and will be in charge of all sales to railroads, aircraft and motor coach manufacturers, government departments and industrial concerns. Mr. Corlette's headquarters are in Chicago where he will direct the sales of the present New York, Detroit and Washington offices and of additional branches to be established later.

N. B. McRee, service engineer of the **United States Graphite Company** has been promoted to manager of railroad sales to succeed **W. R. Pflasterer,** resigned. Mr. McRee was born on November 1, 1891, at Ruthville, Tenn., and entered railway service in 1912 as a traveling electrician on the Chicago, Rock Island & Pacific. In 1917 he joined the navy and in 1918 returned to private life and entered the employ of the Kansas City Terminal Company at Kansas City, Mo. He returned to the Chicago, Rock Island & Pacific in 1922 as a traveling electrician, which position he held until February 15, 1926. On this date he became service engineer of the United States Graphite Company, which position he has held until his recent promotion.

Lewis C. Haigh of the sales department of the **Magor Car Corporation** has been elected secretary with headquarters at New York. Mr. Haigh was born in Brooklyn, N. Y., on January 30, 1898. He received his education in the public schools of New York and East Orange, N. J., and prepared for college at St. Paul Academy, St. Paul, Minn. He also attended Wharton School, University of Pennsylvania for two years. Mr. Haigh entered the service of the Magor Car Corporation early in 1922 and after serving for one year in the shops at Passaic, N. J., joined its sales force in the New York office, where he was employed at the time of his recent election.

Lewis C. Haigh

Howard Mull, who has been elected vice-president of the **Warren Tool & Forge Company,** Warren, Ohio, was in the engineering department of the Cleveland, Cincinnati, Chicago & St. Louis from 1909, to November, 1913, at which time he was transferred to the operating department at Cleveland. On May 1, 1913, he left the Big Four to become associated with the Verona Tool Works and was made traveling

representative in December, 1914. He was given charge of the Chicago territory in 1916, and held this position until June, 1918, when he was placed in complete charge of sales, resigning December 31, 1920, to enter the employ of the Warren Tool & Forge Company, as manager of the railroad department, which position he has held until his recent promotion to vice-president.

Ralph S. Cooper, vice-president and general manager of the **Independent Pneumatic Tool Company,** Chicago, has been elected president to succeed **John D. Hurley,** deceased. **Neil C. Hurley** has been elected a member of the executive committee and **Raymond J. Hurley** has been elected a director. Mr. Cooper graduated from Cornell University in 1903. He entered the employ of the Independent Pneumatic Tool Company immediately after graduation and has been successively manager of the New York office, eastern manager and vice-president in charge of eastern sales, the position he was holding at the time of his election as president.

Trade Publications

Welded Chain.—The American Chain Company has issued a six-page pamphlet containing convenient tables and useful information for the users of welded chain for specific purposes. A list of "Don'ts" is appended as suggestions for the proper care of these adjuncts.

Power Drill Sharpener.—The Sullivan Machinery Company, Chicago, has issued a new bulletin, No. 72-N, which contains a complete description of the new Sullivan light model, Class "C," all-hammer drill sharpener. This bulletin is prepared in the form of a magazine article and gives a clear description which is accompanied by a number of excellent illustrations.

Materials Are Important.—The Page Steel & Wire Company, Bridgeport, Conn., has issued a pamphlet with the foregoing title, explaining why welding wires should be subjected to special processing to produce good welds, as well as the importance of making these wires from the highest grades of iron and steel. The pamphlet also contains suggestions as to the types of wire to be used for various welding jobs.

Underdrainage.—In a booklet of 20 pages recently issued by the Toncon Culvert Manufacturers Association, Massillon, Ohio, considerable valuable information on the subject of drainage is presented in a compact form. Its primary purpose is to cover the use of perforated corrugated pipes in lowering the ground water level in soil, and in the presentation, attention is given first to rainfall and runoff, followed by a discussion of the flow of underground waters, formulas and tables for flow through pipe and separate short chapters on the drainage of tracks, highways, airports, etc.

Personal Mention

General

A. H. Freygang, division engineer of the Akron division of the Baltimore & Ohio, with headquarters at Akron, Ohio, has been appointed assistant superintendent of the Akron division, with headquarters at the same point.

Martin F. Jaeger, assistant superintendent of the Port Reading Creosoting Plant of the Reading and the Central Railroad of New Jersey at Port Reading, N. J., has been promoted to superintendent of this plant, succeeding **G. C. Stephenson,** who resigned to take employment with the American Tar Products Company, Pittsburgh, Pa. Mr. Jaeger was born on June 10, 1895, at Newark, N. J., and entered the service of the Reading on July 25, 1915, immediately after graduation from the Woodbridge High school at Newark.

E. I. Rogers, chief engineer of the Peoria & Pekin Union, has been elected president, with headquarters as before at Peoria, Ill. Mr. Rogers was born on August 3, 1876, at St. Joseph, Mo., and graduated from a civil engineering course at the University of Missouri. He entered railway service in 1897, as a track apprentice on the Illinois Central. He was later advanced to instrumentman and, in 1903, was promoted to assistant engineer at Memphis. Later he was promoted to roadmaster at Vicksburg, Miss., where he remained until 1912, when he was appointed chief engineer of the Muskogee, Oklahoma & Gulf, with headquarters at Muskogee, Okla. He then served as an engineer with the Lorimer & Gallagher Construction Company and chief engineer with the Texas

E. I. Rogers

Transit Company. In 1916 Mr. Rogers returned to the Illinois Central as an engineer in the valuation department, and shortly thereafter was appointed assistant roadmaster at Fort Dodge, Ia. In October, 1916, he was promoted to roadmaster of the Iowa division, with headquarters at the same point, where he remained until August, 1921, when he was appointed chief engineer of the Peoria & Pekin Union.

Colonel N. L. Howard, an engineer by training and experience, has retired from the presidency of the Chicago Great Western owing to ill health. He was born at Fairfield, Iowa, on March 9, 1884, and was graduated from the United States Military Academy 23 years later. He entered railway service in the engineering department of the

N. L. Howard

Chicago, Burlington & Quincy, but later was transferred to the operating department, in which he was advanced to trainmaster at Centerville, Iowa, assistant superintendent at Galesburg, Ill., and superintendent of the Burlington division at Burlington, Iowa. In 1916, he was transferred to the Hannibal division at Hannibal, Mo., where he remained until the outbreak of the World War. Mr. Howard entered the United States Army in May, 1917, as lieutenant-colonel of the Thirteenth Engineers Railway, and from August of that year until the spring of 1918, he served with the director general of transportation in France, and during the remainder of the war he was in command of the Thirteenth Engineers Railway in the Verdun section, both as lieutenant-colonel and colonel. Upon his return to the United States in May, 1919, Mr. Howard was appointed assistant to the federal manager of the Burlington at Chicago, later being appointed general superintendent of the Missouri district of that road with headquarters at St. Louis, where he remained from November, 1919, to July, 1923, when he was promoted to superintendent of transportation, with headquarters at Chicago. Col. Howard was appointed general manager of the Chicago Union Station Company in August, 1924, and became president of the Chicago Great Western in November, 1925.

J. L. Downs, district engineer on the Northern lines of the Illinois Cen-

tral, with headquarters at Chicago, has been appointed superintendent of the Illinois division, with headquarters at Champaign, Ill. Mr. Downs was born and obtained his high school education at Greencastle, Ind. He entered railway service in 1896, as a section foreman on the Illinois Central, and in the following year was promoted to supervisor at Kankakee, Ill. For the next

J. L. Downs

28 years Mr. Downs served successively as supervisor at Kankakee and at Rantoul, Ill., roadmaster at Fort Dodge, Iowa, Vicksburg, Miss., Memphis, Tenn., and Champaign, Ill. In 1925, he was promoted to district engineer on the Northern lines of the Illinois Central, with headquarters at Chicago, which position he was holding at the time of his appointment as superintendent of the Illinois division, which became effective on October 1.

Engineering

J. E. Kissell, division engineer on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Galion, Ohio, has been transferred to Bellefontaine, Ohio.

G. S. Lovering, principal assistant engineer of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., has been promoted to assistant chief engineer, with the same headquarters. **P. M. Stutrud** has been appointed office engineer at Minneapolis.

O. R. West, division engineer on the Atchison, Topeka & Santa Fe, with headquarters at Needles, Cal., has been transferred to the San Francisco Terminal division to succeed **F. D. Kinnie,** whose promotion to district engineer was noted in the October issue. **R. E. Chambers** has been promoted to division engineer to succeed Mr. West.

D. E. Gelwix, following the abolition of the position of maintenance assistant to the general manager of the St. Louis-San Francisco on September 1, has returned to his former position as division engineer of the Eastern division of this road, with headquarters at Springfield, Mo. **E. L. Anderson,** who had succeeded Mr. Gelwix as division engineer of the Eastern division, resumed his former duties as assistant division engineer, with headquarters at the same place.

Roy Leas, office engineer in the office of the district engineer of the Chicago, Rock Island & Pacific at El Reno, Okla., has been promoted to division engineer of the Pan Handle division, with headquarters at the same point, succeeding **A. H. Sturdevant,** who has been transferred to the Oklahoma-Southern division, with headquarters at Fort Worth, Tex.

J. F. Donovan, division engineer on the Lehigh Valley, with headquarters at Easton, Pa., has been appointed assistant chief engineer of maintenance, with headquarters at Bethlehem, Pa. **R. E. Patterson,** division engineer at Sayre, Pa., has been transferred to Easton to succeed Mr. Donovan. **A. B. Shimer,** assistant division engineer, with headquarters at Auburn, N. Y., has been promoted to division engineer to succeed Mr. Patterson. The positions of general inspector maintenance of way and of assistant division engineer on the Auburn division have been abolished.

R. L. Pearson, engineer maintenance of way, of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., has been promoted to chief engineer, with the same headquarters, to succeed **Edward Gagel,** whose retirement is noted elsewhere in these columns. **E. E. Oviatt,** maintenance engineer at New Haven, will succeed Mr. Pearson. **A. L. Bartlett,** division engineer of the New Haven division, has been promoted to maintenance engineer for the Western lines, retaining his headquarters at New Haven. He is succeeded by **G. W. Curtiss,** division engineer of the Danbury division, with headquarters at Danbury, Conn. **A. A. Cross,** assistant division engineer on this division, has been promoted to division engineer to succeed Mr. Curtiss.

E. W. Backes, resident engineer on the Boston & Maine, with headquarters at Concord, N. H., has been promoted to assistant division engineer, with headquarters at Brattleboro, Vt., in charge of grade revision and certain maintenance work. **Samuel H. Scribner,** supervisor of track at Rochester, N. H., has been promoted to assistant engineer, with headquarters at Dover, N. H.

Mr. Backes was born on June 21, 1902, in New York City, and received his higher education at the Pennsylvania Military College, and at Yale, having been graduated from the latter institution in 1922 with a degree of C. E. He entered railway service on September 15, 1922, as an inspector on the Havana Electric Railway, Light & Power Company, and in October, 1925, he was promoted to engineer of ways of that road. In May, 1927, he left this road to become a general foreman on the Boston & Maine, and in October of the same year he was promoted to assistant engineer. In February, 1929, he was promoted to resident engineer at Concord, which position he was holding at the time of his recent promotion to assistant division engineer.

W. R. Gillam, division roadmaster of the St. Louis division of the Illinois Central, has been promoted to district engineer on the Northern lines of this road, to succeed **J. L. Downs,** whose promotion to superintendent on the Illinois division, is noted elsewhere in these columns.

Edward Gagel, chief engineer of the New York, New Haven & Hartford, with headquarters at New Haven, retired on October 1, after more than half of a century of active railroad work. He was born at Mount Hope, N. Y., on October 25, 1858. He received his education at Cooper Institute, New York, and entered railroad service with the Brooklyn, Flatbush & Coney Island railroad in December, 1877. In April, 1879, he became assistant engineer for the Metropolitan Elevated and early in the following year he spent a few months as a draftsman for the West Side & Yonkers railway. In March, 1880, he went with the New York & New England (now part of the New Haven) as a levelman and draftsman. During 1882, he was successively a transitman for the Erie & Wyoming Valley, engineer for the Pittsburgh, McKeesport & Youghiogheny and draftsman for the New York Central. In December, 1882, he first entered the service of the New York, New Haven & Hartford as a draftsman; in November, 1885, he was appointed an assistant engineer and in June, 1891, he became district engineer. In July, 1900, he again became an assistant engineer and in June, 1904, he was made principal assistant engineer. In October, 1905, Mr. Gagel was appointed chief engineer of the system, remaining in this position until his retirement on October 1 of this year.

Edward Gagel

Changes on the Baltimore & Ohio

H. Harsh, division engineer on the Pittsburgh division, with headquarters at Pittsburgh, Pa., has been transferred to Akron to succeed A. H. Freygang, whose promotion to assistant superintendent is noted elsewhere in this issue. **G. B. Farlow,** division engineer

on the Monongah division, with headquarters at Grafton, W. Va., has been transferred to Pittsburgh to replace Mr. Harsh. **John Edwards,** assistant engineer maintenance of way and structures, with headquarters at Pittsburgh, has been promoted to division engineer to succeed Mr. Farlow. **H. N. Anderson,** assistant division engineer on the Pittsburgh division, with headquarters at Pittsburgh, has been promoted to assistant engineer maintenance of way and structures to replace Mr. Edwards. **J. G. Collinson,** supervisor of road on the Connellsville division, with headquarters at Meyersdale, Pa., has been promoted to assistant division engineer to replace Mr. Anderson.

Track

F. P. Barrick, track supervisor on the Chesapeake & Ohio, with headquarters at Ashland, Ky., has been transferred to Louisa, Ky.

M. C. Dempcy has been appointed assistant supervisor on the Pennsylvania, with headquarters at New Kensington, Pa.

Walter C. Smith has been appointed roadmaster of the Dakota division of the Northern Pacific with headquarters at Jamestown, N. D.

J. C. Nickerson, roadmaster on the Kentucky division of the Louisville & Nashville, with headquarters at Paris, Ky., has been transferred to Latonia, Ky., coincident with the transfer of division headquarters to that point.

F. W. Skeates, Jr., assistant accountant on the Canadian National, in the office of the superintendent at Montreal, Que., has been promoted to assistant roadmaster at Farnham, Quebec, to succeed **L. Hebert,** who died on March 17.

Andrew Larson, roadmaster on the Northern Pacific, with headquarters at Spokane, Wash., who has been on leave of absence, resumed his duties on September 16, relieving **Tony Zangar,** who has returned to his former position as assistant roadmaster on the Idaho division.

F. G. Rettig, assistant supervisor on the Buffalo division of the Pennsylvania, has been transferred to the Conemaugh division, to succeed **R. D. Ministerl,** resigned. **J. W. Mills** has been appointed assistant supervisor on the Buffalo division to succeed Mr. Rettig.

W. J. Schmidt, supervisor of road on the Charleston division of the Baltimore & Ohio, with headquarters at Weston, W. Va., has been transferred to the Connellsville division to relieve J. G. Collinson whose promotion is noted elsewhere. **H. O. Hutson** has been appointed supervisor of road to succeed Mr. Schmidt. **Phil G. Petri,** levelman on the engineering corps of the Cumberland division, has been promoted to assistant supervisor, with headquarters at Rockwood, Pa.

E. Gunderson, roadmaster on the Smithers division of the Canadian National, with headquarters at McBride, B. C., has been transferred to Prince George to succeed **D. Deneen,** who has been appointed roadmaster at Smithers on the same division to replace **J. O. Meshewilk,** acting roadmaster, who has been transferred to McBride.

H. S. Williamson, roadmaster on the Gulf, Mobile & Northern, with headquarters at Laurel, Miss., has been transferred to New Albany, to succeed **A. A. Miller,** whose death is noted elsewhere in these columns. **W. M. Carmichael,** track supervisor at Laurel, has been promoted to roadmaster to succeed Mr. Williamson. The territory heretofore under the supervision of Mr. Garmichael has been distributed among the remaining supervisors' districts.

N. A. Camera, formerly with the road department of the Baltimore & Ohio on its Washington terminal, has been appointed supervisor on subdivision No. 3 of the Central Railroad of New Jersey, with headquarters at Allentown, Pa., to succeed **S. G. Phillips,** who has been transferred to subdivision No. 1, with headquarters at Jersey City, N. J. Mr. Phillips succeeds **T. H. Egan,** resigned.

D. J. Vallier, track supervisor on the Boston & Maine, with headquarters at Boston, Mass., has been transferred to district No. 3, with headquarters at Plymouth, N. H., succeeding **H. P. Mason,** who has been transferred to the Terminal division, with headquarters at Boston. **Harold S. Ashley** has been appointed track supervisor of district No. 4, with headquarters at Rochester, N. H., succeeding **Samuel H. Scribner,** whose promotion to assistant engineer is noted elsewhere in these columns.

Curtis H. Kooser, whose promotion to supervisor on the Pennsylvania, was noted in the September issue, was born on May 22, 1901, at Manor, Pa., and graduated from the University of Pittsburgh in 1926. He entered railway service with the Pennsylvania on June 7, 1926, at Trafford, Pa., where he served as rodman until January 1, 1928, when he was promoted to assistant supervisor, with headquarters at Buffalo. On November 16, 1928, Mr. Kooser was transferred to Trafford where he remained until his recent promotion to supervisor on July 1, 1929, with headquarters at Monongahela, Pa.

H. S. Chandler, whose promotion to supervisor of track on the Rivanna sub-division of the Richmond division of the Chesapeake & Ohio, with headquarter at Richmond, Va., was noted in the September issue, was born on February 2, 1892, near Keswick, Va. He entered the service of the Chesapeake & Ohio in 1915, as a section laborer and was promoted to section foreman on December 26, 1916. On January 1, 1929, he was promoted to assistant cost engineer.

F. W. Lemon, supervisor of track on the New York Central, with headquarters at Alliance, Ohio, has been transferred to Adrian, Mich., to succeed **T. W. Dempsey,** deceased. **C. W. Thornton,** assistant supervisor, with headquarters at Cleveland, Ohio, has been promoted to supervisor at Alliance, to replace Mr. Lemon. **Charles Wehrle,** assistant supervisor at Hillsdale, Mich., has been transferred to Cleveland to relieve Mr. Thornton. **J. H. Davis,** instrumentman on the engineering corps, at Detroit, Mich., has been promoted to assistant supervisor at Hillsdale.

John Johnson, supervisor of track on the West Shore division of the New York Central, with headquarters at Newburgh, N. Y., retired from active duty on July 31, after more than 47 years of continuous service with that road and the West Shore, which is now part of the New York Central. Mr. Johnson's first railway service was with the New York, Ontario & Western as a track laborer. In 1882, he was appointed section foreman on the West Shore, holding this position until 1899, when he was promoted to supervisor of track, the position he was holding at the time of his retirement.

James P. Newell, whose promotion to supervisor of track on the Pennsylvania, was noted in the September issue, was born in Carthage, Mo., on September 18, 1902, and graduated from the civil engineering department of Princeton University in 1924. He entered railway service with the Pennsylvania in 1927, as assistant on the engineering corps of the Pittsburgh division and on April 1, 1928, was promoted to assistant supervisor of track, with headquarters at Sharpsburg, Pa., later being transferred to Carnegie, Pa., where he served until his promotion on July 15, 1929, to supervisor of track, with headquarters at East Aurora, N. Y.

L. M. Knopp, on the engineering corps of the New York Central, has been appointed assistant track supervisor on subdivision No. 15 of the Ontario division, at Charlotte, N. Y., to succeed **C. T. Gunsallus,** who has been appointed second assistant supervisor of track, on subdivision No. 20, on the River division, at Newburgh, N. Y. **S. Humphries,** extra gang foreman, has been promoted to first assistant supervisor on subdivision No. 7A of the Mohawk division, at Oneida, N. Y., succeeding **G. W. Clark,** who has been promoted to supervisor of track on the St. Lawrence division, with headquarters at Carthage, N. Y. Mr. Clark succeeds **H. B. Lincoln,** who has been transferred to the River division, with headquarters at Weehawken, to replace **John Johnson,** who was located at Newburgh, N. Y., until his retirement on July 31, as mentioned elsewhere in this issue.

H. O. Pritchard, whose promotion to supervisor on the Pennsylvania, with headquarters at Hollidaysburg, Pa., was noted in the October issue, was born in October 29, 1885, at West Smethwick, England, emigrating to the United States with his parents at the age of three. He received his educa-

tion in the public schools of Hatboro, Pa. On February 5, 1900, he entered railway service with the Pennsylvania as a track laborer. On January 2, 1902, he was promoted to assistant foreman, and on August 1, 1906, he was promoted to track foreman. On August 1, 1920, he was transferred to West Chester, Pa., and on August 8, 1927, he was promoted to main line assistant supervisor, at Tyrone, Pa. On September 7, 1928, he was transferred to Ernest, Pa., where he was located at the time of his recent promotion to supervisor of track.

Bridge and Building

O. S. Rudolph has been appointed acting master carpenter of the Buffalo division of the Pennsylvania, with headquarters at Olean, N. Y., to succeed **W. R. Taggart,** who has been transferred to the Eastern region.

James C. Wade, supervisor of water stations on the Cincinnati division of the Louisville & Nashville, with headquarters at La Grange, Ky., has been retired from active duty after 47 years of continuous service with that road.

J. J. Sekinger, supervisor of bridges and buildings on the Illinois Central, with headquarters at Champaign, Ill., has been transferred to the Chicago Terminal division to succeed **Charles E. Ettinger,** resigned. **J. H. Morgan,** general foreman of maintenance on the East St. Louis Terminal division, has been promoted to supervisor of bridges and buildings to succeed Mr. Sekinger. **A. J. Butler,** general foreman of maintenance on the Edgewood cut-off, with headquarters at Effingham, Ill., has been transferred to East St. Louis to take Mr. Morgan's place. **Sumner Williams,** extra gang foreman, has been promoted to general foreman of maintenance to succeed Mr. Butler.

W. Z. Gahman, whose promotion to master carpenter of the Renova division of the Pennsylvania, with headquarters at Erie, Pa., was reported in the September issue, was born on August 15, 1899, and received his education at Ohio Northern University, from which he graduated in 1925. In June, 1925, he entered the service of the Pennsylvania as a rodman on the Pittsburgh division, and in October, 1927, he was placed in charge of new line construction between Derry, Pa., and Donahue, where he served until January, 1929, when he was promoted to assistant master carpenter of the Pittsburgh division, which position he was holding at the time of his recent promotion to master carpenter, on July 15, 1929.

Warren S. Miller, whose promotion to supervisor of bridges and buildings on the Third division of the Oregon-Washington Railroad & Navigation Company, with headquarters at Walla Walla, Wash., was noted in the September issue, was born on December 29, 1883, at Prineville, Ore. He entered the service of the O.-W. R. R. & N. Co., in 1905, as a bridge and building carpenter and, in 1909, was promoted to bridge and building foreman. In 1916, he was again promoted to bridge and building supervisor, from which position he resigned in 1920. Mr. Miller re-entered the services of this company in January, 1924, as pile driver engineer and was again promoted to bridge and building foreman in 1927, holding this position until his recent promotion to supervisor of bridges and buildings.

Changes on the New York Central

J. G. Fisk, pile driver foreman on the St. Lawrence division of the New York Central, has been promoted to assistant supervisor of bridges and buildings on this division with headquarters at Watertown, N. Y., succeeding **C. T. Tanner,** who has been promoted to supervisor of bridges and buildings on the Mohawk division, with headquarters at Utica, N. Y. Mr. Tanner, in turn, succeeds **Isaiah Vosburgh,** whose promotion to general bridge inspector on lines east of Buffalo, was noted in the October issue. **G. W. Pfenniger,** bridge and building inspector on the Syracuse division, with headquarters at Rochester, N. Y., has been promoted to assistant supervisor of bridges and buildings on the Syracuse division, with the same headquarters, succeeding **W. Cavanaugh,** who has been promoted to supervisor of bridges and buildings on the Mohawk division at Malone, N. Y. Mr. Cavanaugh succeeds **T. P. Soule,** who has been transferred to Albany, N. Y., to take the place of **J. H. Hamer,** whose death was reported in the October issue.

Obituary

P. E. O'Connell, supervisor of track on the Iowa division of the Illinois Central, died suddenly on August 2 at his home in Manley, Iowa.

Charles L. Carpenter, a former railway officer and engineer in Cuba, died at the age of 62 years of heart disease, near Maniwaki, Que., on September 28.

T. W. Dempsey, supervisor of track on the New York Central, at Adrian, Mich., died on September 12, as the result of a carbuncle infection.

Richard D. Watkins, track supervisor on the Louisville & Nashville, with headquarters at Paris, Tenn., died on August 19, after several months' illness.

John Lucey, who has spent the past 12 years in locating and constructing railways in Mexico and Central America, died at his home in Yonkers, N. Y., on September 16.

W. Cayley, bridge and building supervisor on the Canadian National with headquarters at Stratford, Ont., died suddenly on October 17 at the age of 63 years.

J. Kiley, general inspector maintenance of way of the Lehigh Valley, with headquarters at Bethlehem, Pa., died in a Philadelphia hospital on September 25, after three months' illness.

Albert B. Lewis, roadmaster on the Southwestern division of the St. Louis-San Francisco, died August 10, of acute appendicitis, at Baylor hospital in San Antonio. Mr. Lewis had been in the employ of this road, as section foreman and roadmaster, for the past 34 years.

Thomas H. O'Brien, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, died suddenly on October 7, while seated in his automobile. Mr. O'Brien had suffered a nervous breakdown in April, and was on leave of absence at the time of his death.

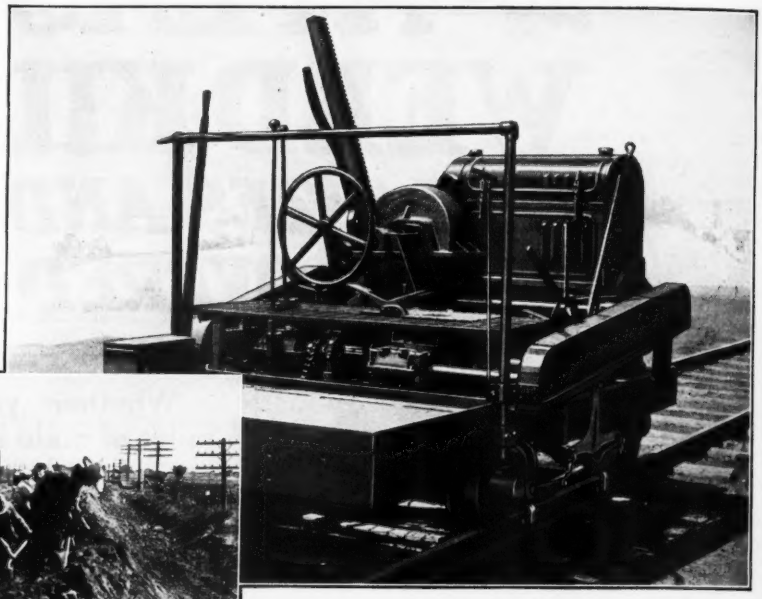
A. A. Miller, roadmaster on the Gulf, Mobile & Northern, with headquarters at New Albany, Miss., died on October 5. Mr. Miller entered the service of this company in 1898, as a section laborer. He was promoted successively to section foreman, extra gang foreman and supervisor, and on January 1, 1912, to roadmaster, the position he held at the time of his death.

Arthur T. Phipps, formerly supervisor of bridges and buildings on the New York Central, with headquarters at Kankakee, Ill., died at his home in Youngstown, Ohio, on August 26. Mr. Phipps, who was pensioned in 1919, entered the service of the New York Central in 1874, as a helper in the bridge department, and received several promotions up to 1892, when he was again promoted to supervisor of bridges and buildings, with headquarters at Kankakee, Ill.

John H. Hamer, supervisor of bridges and buildings on the Mohawk division of the New York Central, whose death was noted in the October issue, entered the employ of the New York Central in 1890 as a carpenter foreman, with headquarters at New York City. In 1892 he was promoted to inspector on the staff of the chief engineer, with the same headquarters, and in 1894 he was promoted to supervisor of buildings, having charge of the maintenance of the old Grand Central terminal. In 1898 he was transferred to the Mohawk division, with headquarters at Albany, N. Y., and in 1921 he was promoted to supervisor of bridges and buildings on this division, which position he was holding at the time of his death.

William J. Krome, an engineer of wide railway experience, died at his home in Homestead, Fla., on October 2. Mr. Krome was born on February 14, 1876, at Edwardsville, Ill., and was educated at Northwestern University, DePauw University and Cornell University. He entered railway service in 1899, serving successively as locating engineer on the Atlantic Valdosta & Western (now the Georgia Southern & Florida); resident engineer of the Georgetown & Western (now part of the Seaboard Air Line); division engineer on the Southern Missouri; assistant engineer on the Florida East Coast; principal assistant engineer of the Key West extension of the latter road, and construction engineer of the Key West extension, in which capacity he supervised the construction of the overseas railroad from the Florida mainland to Key West.

3500 feet of track raised 22 inches in four hours / One Man Did It!



The new Model "S" Track Machine is much faster in its action and more simple in its operation, than the model it replaces.

The Track Machine equipped with leveling spuds for lifting track vertically is being used on heavy main line grade raising.

On this grade raising job on the Santa Fe in Texas, no big jack gang was required. The Track Machine with its one operator is taking its place. To make this speed with the thermometer registering 104° in the shade, and no shade, would have been "killing" to the jack gang. This, however, is typical of what this unusual machine is doing on many roads where it is being used for raising and shifting work. For building fills, heavy raising, elevation work, yard construction on railroads, construction jobs, open pit mines and quarries, this machine will soon save its first cost out of labor that it replaces.

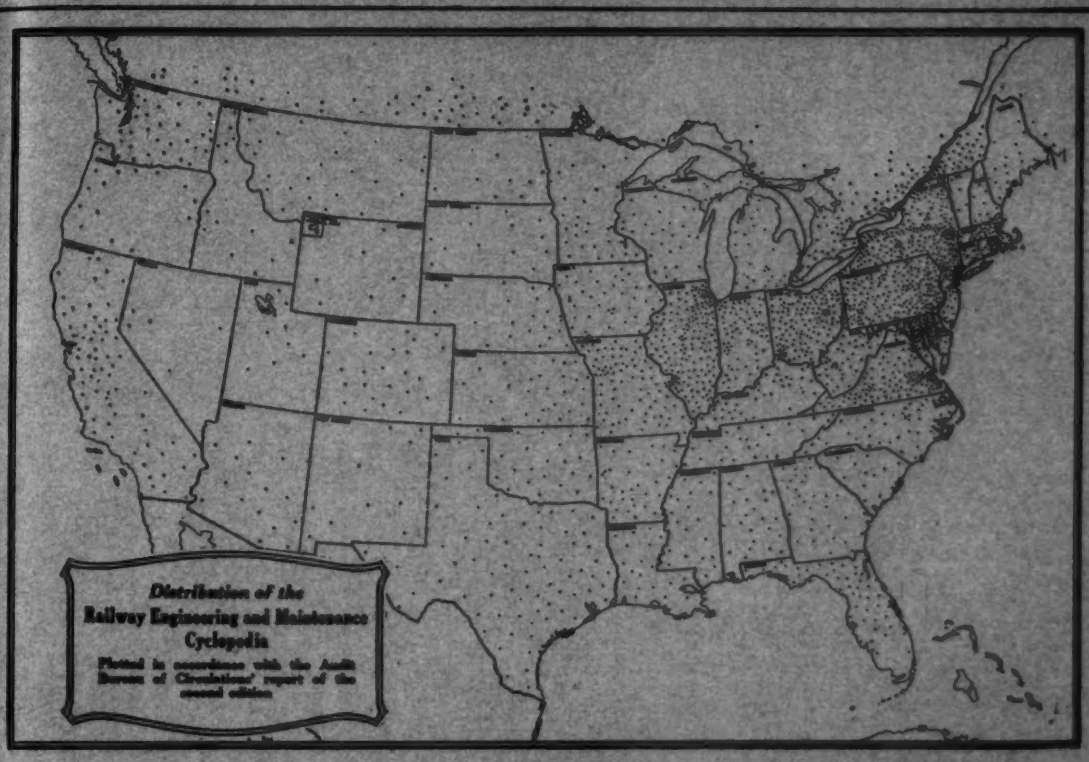
Other Labor Saving Track Machinery Built by Nordberg

Two other labor saving machines of interest to those engaged in track maintenance, are the Tie Adzing Machine and Power Jack. With these new machines, it is no longer necessary to adz ties by hand when relaying steel, or to use jack men on ballasting and surfacing jobs.

May we send you further particulars about these machines?

Nordberg Mfg. Co., Milwaukee, Wis.

THE NORDBERG PATENTED TRACK MACHINE



Put Your Name on the 1929 Map

Two thousand executive and engineering officers, roadmasters, master carpenters, signal supervisors, and other maintenance-of-way men on 300 American railways are now using the new Third Edition of the *Railway Engineering and Maintenance Cyclopedia*. Railway men in 24 countries outside of the United States and Canada have also ordered copies.

This is the only reference volume containing the latest information on railway equipment and problems pertaining to track, bridges, buildings, water service, signaling, and such general subjects as wood preservation. The authoritative character of this information is insured by the cooperation given by the American Railway Engineering Association and the American Railway Association's Signal Section.

With a copy of this big new cyclopedia on your desk or within easy reach you can save yourself a lot of time and trouble in obtaining dependable and up-to-date technical information. All the basic and essential details of approved practices, equipment and appliances in railway engineering and maintenance are clearly and concisely presented. Full indexes facilitate quick reference to any phase of a subject in any of the 100 chapters

Contains Seven Big Sections

Each of the seven big sections of the Cyclopedia is an ordinary sized book in itself:

DEFINITION SECTION, based upon the official terminology of the A. R. E. A. the Signal Section, A. R. A. the A. W. P. A., etc.

TRACK SECTION, covering every phase of track construction and maintenance.

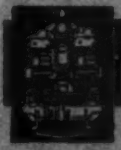
BRIDGE SECTION, covering the construction, equipment and maintenance of all kinds of railway bridges.

BUILDING SECTION, describing in detail all of the important buildings coming under the supervision of the building department.

WATER SERVICE, describing the sources of water supply and methods of treatment, distribution and storage.

SIGNAL SECTION, containing the only up-to-date, authoritative description of signaling devices and practices in book form.

GENERAL SECTION, covering wood preservation, metals, paint, power units, wire rope and chain, etc.



SIMMONS-BOARDMAN

FREE EXAMINATION COUPON

Simmons-Boardman Publishing Company
30 Church Street, New York

Please send me postpaid a copy of the { $5.00 cloth / $7.00 leather } 1929 Edition of the Railway Engineering and Maintenance Cyclopedia for ten days' free examination. After ten days I will remit the total price, or if I do not desire to keep the book I will return it to you in good condition.

NAME.....

ADDRESS.....

CITY.....STATE.....

POSITION.....COMPANY.....

RE&M-11-29

This Book Was Written for You, Mr.—

President
Who has to keep in general touch with new developments in all branches of engineering and maintenance to insure the utilization of the most efficient methods by his road.

Vice-president of Operation
The executive officer who in the end must authorize expenditures, uses it as a guide to efficient purchasing.

General Manager
The operating officer who has general supervision over, without being closely in touch with details of maintenance work, can quickly find in it detailed information to check recommendations of his subordinate officers.

General Superintendent
The staff officer in direct charge of operation finds many facts he needs to refer to, instantly available in this book.

Purchasing Officer
He must often reconcile differences between materials and devices requisitioned and determine what the market affords. He finds it quickly with the aid of the index.

Chief Engineer
The higher engineering officer who selects and specifies the device or materials to be used on a job, can make sure of best practice by refering to adopted specifications and other important data.

Division Engineer
This book is widely used by him as a one volume library. He finds it the most useful of his few technical books.

Signal Engineer
The Signal Section constitutes the only complete and up-to-date book on signal equipment and maintenance practice in all its varied details.

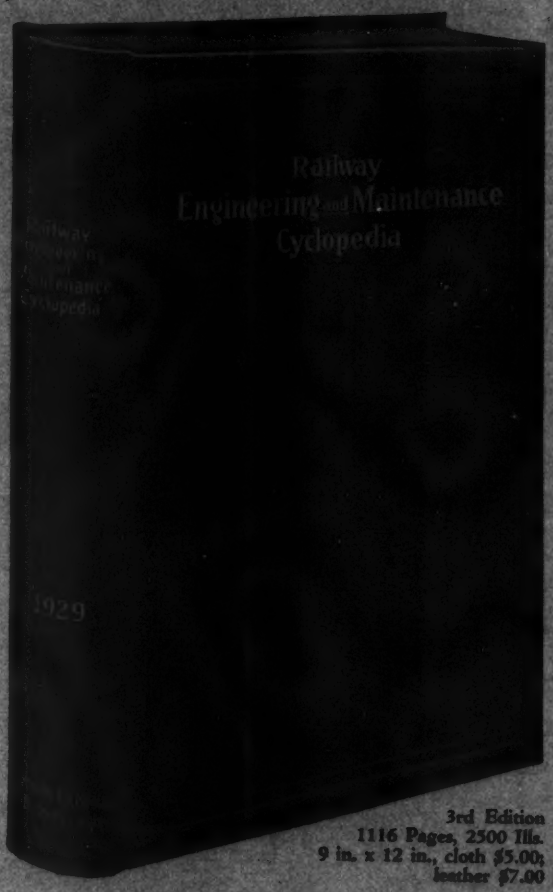
Bridge Engineer
He finds in the Cyclopedia a great deal of information regarding track building and signal standards which he needs from time to time, in addition to a thoroughly up-to-date book on modern materials, equipment and methods of bridge work.

Building Engineer
The Building Section furnishes the engineer in charge of building construction the recommended practices of the A. R. E. & B. A., and valuable data of other branches of railway engineering with which he co-operates.

Roadmaster or Supervisor of Track
To properly supervise the work of gang foremen and answer their many questions as to best methods of procedure, the roadmaster will find the Track Section a mine of exact information.

Master Carpenter
Specifications for B. & B. work can be verified, and a great deal of valuable and practical information found in the Bridge and Building, as well as other sections.

Water Service Supervisor
The Water Service Section is an excellent treatise on the newest phases of the subject and is also used as a handy reference manual for standard requirements of other co-ordinated departments.



3rd Edition
1116 Pages, 2500 Ills.
9 in. x 12 in., cloth $5.00;
leather $7.00

More than two-thirds of the limited edition of 3,000 copies of the *Railway Engineering and Maintenance Cyclopedia* have been distributed since its publication on July 22. At this rate it will be out of print within a few weeks. The next edition will not appear until 1932.

Order Your Copy Today

Simply filling out, detaching and mailing the Free Examination Card will bring you a copy of this helpful Cyclopedia for ten days. Give it a fair working tryout on the job. Let it help you on important problems. See how much quicker you can check up on the information you need to make correct decisions.

Then if you decide that this standard authority has earned a place for itself on your reference shelf you can remit the very moderate list price. Otherwise simply send it back. We feel sure you will want to keep it because returns have been less than two per cent.

FREE Examination Coupon for the 1929 Edition of the Railway Engineering and Maintenance Cyclopedia

Fill in the coupon on reverse side, tear out and mail to

Simmons-Boardman Publishing Company

30 Church Street
New York, N. Y.

105 W. Adams Street
Chicago, Ill.

Lowest Cost Per Gallon

. . . measured by years of service is an outstanding characteristic of Dixon's Industrial Paints

Known for more than 65 years as Dixon's Silica-Graphite Paints, they are composed (with the exception of Bright Aluminum and Standard Oxide Red) of pure boiled linseed oil combined with the highest grade of flake silica-graphite.

And flake silica-graphite has proved, over the years, to be an unusual pigment for metal protective paints. It is absolutely inert, and is not affected by the action of gases, acids, alkalis, and other destructive agents. It has a peculiar quality of "water repellancy" and as corrosion does not occur except in the presence of moisture, much longer protection is assured.

A complete line of industrial paints in 14 colors, including Bright Aluminum, and Standard Red Oxide is now offered.

Write for color card No. 187 BI.

DIXON'S Maintenance Floor Paints

give maximum protection to wood, composition, concrete and cement floors. Suitable for use either indoors or outside. Made in 8 standard colors. Write for color card No. 187 BF.

JOSEPH DIXON CRUCIBLE CO.

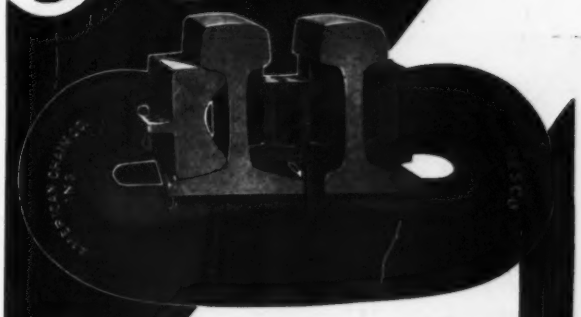
Paint Sales Division

Established 1827

Jersey City, N. J.

DIXONS INDUSTRIAL PAINTS

Safe!



Resco Cast Steel Guard Rail Clamps *will not stretch, bend or break!*

Great strength and shock resisting properties of Resco Guard Rail Clamps make them reliable and failure-proof.

Castings are tough, close-grained Electric Cast Steel, with ample, well designed sections at points of greatest strain.

Resco Guard Rail Clamps are made in all sizes, to fit all rail sections. Write or wire for full particulars, prices, etc.

Other Reading Specialties

ACCO Drop-Forged Guard Rail Clamps
"RESCO" Cast Steel Guard Rail Clamps
ACCO *One-Piece* Guard Rails
Reversible Rail Benders
Samson Rail Benders
Car and Engine Replacers
Replacer Clamps
Compromise Joints

AMERICAN CHAIN COMPANY, *Inc.*
BRIDGEPORT, CONNECTICUT
Largest Manufacturer of Welded & Weldless Chain for Every Railroad Purpose

RESCO Guard Rail Clamps

Classified Advertisements

Use this section when seeking a new man, a new position, or when buying or selling second-hand equipment.

CLASSIFIED ADVERTISEMENTS, $10.00 an inch, one inch deep by three inches wide, an insertion.

EMPLOYMENT ADVERTISEMENTS, 10 cents a word a month, including address, minimum charge $2.00.

Remittance must accompany each order.

Railway Engineering and Maintenance
Classified Department
105 West Adams Street, Chicago

WANTED:

Roadmaster (single), preferably with experience in Southwest; knowledge of Spanish desirable, for work at large Nitrate property, Chile, South America. Three year contract, transportation both ways, and salary while traveling paid by Company. Give complete details first letter; address G. J. C., room 34, No. 240 Broadway, New York City.

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for October, 1929.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. T. DeMott, who, having been duly sworn according to law, deposes and says that he is the Treasurer of the Publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Company and Simmons-Boardman Publishing Corporation, both of 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 105 W. Adams St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 105 W. Adams St., Chicago, Ill.

Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owners are:

Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y. Stock owned by Simmons-Boardman Publishing Corp., 30 Church St., New York, N. Y. Stockholders of 1 per cent or more of the total amount of stock: I. R. Simmons, 1625 Ditmas Ave., Brooklyn, N. Y.; P. A. Lee, Hopatcong, N. J.; H. Anderson, 246 Rugby Rd., Brooklyn, N. Y.; E. G. Wright, 398 N. Walnut St., E. Orange, N. J.; Spencer Trask & Co., 25 Broad St., New York, N. Y.; S. O. Dunn, 105 W. Adams St., Chicago, Ill.; C. E. Dunn, 3500 Sheridan Blvd., Chicago, Ill.; B. L. Johnson, 105 W. Adams St., Chicago, Ill.; W. A. Radford, 105 W. Adams St., Chicago, Ill.; L. B. Sherman, 575 Sheridan Rd., Winnetka, Ill.; Mae E. Howson, 6922 Paxton Ave., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

J. T. DeMott,
Treasurer.

Sworn to and subscribed before me this 30th day of September, 1929.

[SEAL] H. D. Nelson,
(My commission expires March 30, 1931.)

Buyers' Guide

CLASSIFIED INDEX TO ADVERTISERS

Acetylene Dissolved
Oxweld Railroad Service Company

Air Brush
Eclipse Air Brush Co.

Air Compressors
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Generator Set
Buda Co.

Air Hoists
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Lift Pumping Machinery
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Airport Drainage
Armco Culvert Mfrs. Assn.

Aluminum Markers
Premax Products, Inc.

Anchors, Rail
See Rail Anchors

Anti-Creepers, Rail
Bethlehem Steel Co.
Lundie Engineering Co.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Asphalt
Barber Asphalt Co.

Ballast Cleaners
Industrial Brownhoist Corp.

Ballast Spreaders
Jordan Co., O. F.

Ballast Trimmers
Jordan Co., O. F.

Bank Builders
Jordan Co., O. F.

Bank Slopers
Jordan Co., O. F.

Band Saws
American Saw Mill Machinery Co.

Bars
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Bearings, Axle
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Bearings, Roller
Timken Roller Bearing Co.

Bearings, Tapered Roller; Thrust and Journal Box
Timken Roller Bearing Co.

Benders, Rail
See Rail Benders

Bolts
Bethlehem Steel Co.
Illinois Steel Co.

Bonding Outfits, Rail
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Braces, Track
Ramapo Ajax Corp.

Bridge Floors
Armco Culvert Mfrs. Assn.
Illinois Steel Co.

Bridge Warnings
Hastings Signal & Equipment Co.

Buckets
Industrial Brownhoist Corp.

Buckets, Clam Shell
Industrial Brownhoist Corp.

Building Beams, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.

Building Papers
Barber Asphalt Co.

Bumping Posts
Buda Co.
Mechanical Mfg. Co.

Calcium Carbide
Oxweld Railroad Service Co.

Car Replacers
American Chain Co., Inc.

Car, Spreader
Jordan Co., O. F.

Cars, Ballast
See Ballast Cars

Cars, Dump
See Dump Cars

Cars, Hand
Buda Co.
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Northwestern Motor Co.

Cars, Industrial
Koppel Industrial Car & Equipment Co.
Magor Car Corp.

Cars, Inspection
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Motor
Buda Co.
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Section
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply
Northwestern Motor Co.
Woolery Machine Co.

Cars, Velocipede
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Castings
Bethlehem Steel Co.
Timken Roller Bearing Co.
Wharton, Jr. & Co., Inc., Wm.

Catchbasins
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Cattle Guards
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.

Cattle Passes
Massey Concrete Products Corp.

Cement Repair
Barber Asphalt Co.

Cement Roofing Tile
Federal Cement Tile Co.

Chemical Weed Killer
Chipman Chemical Engineering Co., Inc.

Clamshell Buckets
See Buckets, Clamshell

Clips, Adjustable
Ramapo Ajax Corp.

Coal Handling Machinery
Industrial Brownhoist Corp.
Northwest Engineering Co.

Coaling Stations
Fairbanks, Morse & Co.
Chicago Bridge & Iron Works

Compressors
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Compromise Joints
See Joints, Compromise

Concrete Roofing Tile
Federal Cement Tile Co.

Concrete Units, Miscellaneous
Federal Cement Tile Co.
Massey Concrete Products Corp.

Condensers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Corrosion Preventive
Dearborn Chemical Co.

Corrugated Iron
Armco Culvert Mfrs. Assn.

Cranes, Barge, Electric Erecting, Gantry, Locomotive Pillar, Transfer, Tractor, Tractor Crawling, Tunnel, Wharf and Wrecking
Buckeye Traction Ditcher Co.
Harnischfeger Corp.
Industrial Brownhoist Corp.
Northwest Engineering Co.

Creosoted Timber
See Timber, Creosoted

Cribbing, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.

Crossing Gates
Buda Co.
Kalamazoo Railway Supply Co.

Crossings, Highway
Barber Asphalt Co.

Crossings, Rail
Buda Co.
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Culvert Pipe
Armco Culvert Mfrs. Assn.
Massey Concrete Products Corp.
Toncan Culvert Mfrs. Assn.
U. S. Cast Iron Pipe & Fdry. Co.

Culverts, Corrugated Metal
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Culverts, Paved Invert
Armco Culvert Mfrs. Assn.

Curbing
Massey Concrete Products Corp.

Cypress, Red
Southern Cypress Mfrs. Assn.

Derails
Q. & C. Co.
Wharton Jr. & Co., Wm

Derailing Switches
Ramapo Ajax Corp.

Diesel Engines
Buda Co.
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Diesel Electric Power Plants
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Discing Machines
Fairmont Railway Motors, Inc.

Disinfectants
Chipman Chemical Engineering Co., Inc.

Ditchers
Buckeye Traction Ditcher Co.
Harnischfeger Corp.
Jordan Co., O. F.
Northwest Engineering Co.

Doors
Richards-Wilcox Mfg. Co.

Draglines
Northwest Engineering Co.

Drainage Gates
Armco Culvert Mfrs. Assn.

Drains, Perforated
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Drills, Earth
Buda Co.

Drills, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works

Drill Steel, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Track
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.

Dump Cars
Jordan Co., O. F.
Koppel Industrial Car & Equipment Co.
Magor Car Corp.

Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)
See Cranes

Electric Light and Power Plants
Fairbanks, Morse & Co.

Electric Power Units
Northwestern Motor Co.
Syntron Co.

Electric Snow Melters
Lundie Engineering Corp.
Q. & C. Co.

Engines, Gasoline
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Engines, Motor Car
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Oil
Buda Co.
Chicago Pneumatic Tool Co.
Fairbanks, Morse Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.

Excavators
Harnischfeger Corp.
Northwest Engineering Co.

Fences
Q. & C. Co.

Fence Posts
Massey Concrete Products Corp.
Q. & C. Co.

Fibre Angle Pieces, Bushings, Plates, End Posts, etc.
Q. & C. Co.

Fibre Insulation
Q. & C. Co.

Flangers, Snow
Q. & C. Co.

Flangeway Guard
Bethlehem Steel Co.

Float Valves
Fairbanks, Morse & Co.

Floating Roofs
Chicago Bridge & Iron Works

Flood Lights
Oxweld Railroad Service Co.

Floor Coverings
Barber Asphalt Co.

Forging Hammers
Industrial Brownhoist Corp.

Forgings
Bethlehem Steel Co.

Frogs
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Inc., Wm.

Gages, Measuring
Lufkin Rule Co.

Gages, Pressure Gas
Oxweld Railroad Service Co.

Fumigants
Calcyanide Co.

Gas, Acetylene
Oxweld Railroad Service Co.

Gates, Drainage
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Generators, Acetylene-Carbide
Oxweld Railroad Service Co.

Graphite
Dixon Crucible Co., Jos.
U. S. Graphite Co.

Graphite Paint. See Paint, Graphite

Grease, Track
U. S. Graphite Co.

Grinders, Portable
Buda Co.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Guard Rails
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Carnegie Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Guard Rail Clamps
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Hammers, Chipping, Scaling and Calking
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hammer Drills
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hammers, Forge
Sullivan Machinery Co.

Hammers, Riveting
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hand Car Bearings
Timken Roller Bearing Co.

Head Drains, Perforated
Toncan Culvert Mfrs. Assn.

Hangers, Door
Richards-Wilcox Mfg. Co.

Heel Blocks
Bethlehem Steel Co.

Highway Crossings
See Crossings, Highway

Hoisting Machinery
Fairbanks, Morse & Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Hoists, Air Motor
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hose
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

House Lining
Barber Asphalt Co.

Ice Cutters
Jordan Co., O. F.

Insecticides
Calcyanide Co.

Inspection Cars
See Cars, Inspection

Inspection, Engineering
Hunt Co., Robert W.

Insulated Rail Joints
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Insulating Material
Barber Asphalt Co.

Jacks, Bridge
Buda Co.
Kalamazoo Railway Supply Co.

Jacks, Track
Buda Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

Joints, Compromise
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Joint Fastenings
Illinois Steel Co.

Joint, Rail
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

Joints, Step
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.

Junction Boxes
Massey Concrete Product Corp.

BUYERS' GUIDE

Knuckles, Emergency
Q. & C. Co.

Lead, Red
National Lead Co.

Liners, Track
Buda Co.
Rail Joint Co.

Lock Washers
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works

Locomotives, Oil Engine Electric Driven
Ingersoll-Rand Co.

Lubricants
Dixon Crucible Co., Jos.

Lumber
Southern Cypress Mfrs. Assn.

Manganese Track Work
Buda Co.
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.

Markers, Pole
Premax Products, Inc.

Mechanical Painting Equipment
Eclipse Air Brush Co.

Mile Posts
Massey Concrete Products Corp.

Motor Bearings
Timken Roller Bearing Co.

Motor Cars
See Cars, Motor

Motors and Generators
Fairbanks, Morse & Co.

Mowing Machines
Fairmont Railway Motors, Inc.

Non-Derailer
Ramapo Ajax Corp.

Number Plates
Premax Products, Inc.

Nut Locks
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Illinois Steel Co.

Oil Engines
See Engines, Oil

Outhouses
Massey Concrete Products Corp.

Oxy-Acetylene Welding Equipment
Oxweld Railroad Service Co.

Oxygen
Oxweld Railroad Service Co.

Paint
Dixon Crucible Co., Jos.
National Lead Co.
U. S. Graphite Co.

Paint Spray
Eclipse Air Brush Co.

Paint, Graphite
Dixon Crucible Co.
U. S. Graphite Co.

Paint, Metal Protecting
Barber Asphalt Co.
Dixon Crucible Co., Jos.
National Lead Co.
U. S. Graphite Co.

Pavement Breakers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Penstocks
Fairbanks, Morse & Co.

Pile Drivers
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Piling
Carnegie Steel Co.
Jennison-Wright Co.
Massey Concrete Products Corp.
National Lumber & Creosoting Co.
Prettyman & Sons, J. F.

Pipe Carriers
Massey Concrete Products Corp.

Pipe, Cast Iron
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe, Concrete
Massey Concrete Products Corp.

Pipe, Corrugated
Armco Culvert Mfrs. Assn.

Pipe Joint Compound
Dixon Crucible Co., Jos.

Pipe, Sewer
Armco Culvert Mfrs. Assn.
Central Foundry Co.
Massey Concrete Products Corp.

Pipe, Wood
Pacific Tank & Pipe Co.

Plants, Water Treating
Chicago Bridge & Iron Works.

Plates, Miscellaneous
Ramapo Ajax Corp.

Poles
Jennison-Wright Co.
Massey Concrete Products Corp.
National Lumber & Creosoting Co.
Prettyman & Sons, J. F.

Posts, Bumping
See Bumping Posts

Posts, Fence
See Fence Posts

Post Hole Diggers
Buda Co.

Power Plants, Portable
Northwestern Motor Co.
Syntron Co.

Preservation, Timber
Jennison-Wright Co.
National Lumber & Creosoting Co.
Prettyman & Sons, J. F.

Products, Gas
Oxweld Railroad Service Co.

Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston Plunger, Rotary, Sump
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Push Cars
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Push Car Bearings
Timken Roller Bearing Co.

Rail Anchors
Bethlehem Steel Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Anti-Creepers
See Anti-Creepers, Rail

Rail Benders
American Chain Co., Inc.
Buda Co.
Q. & C. Co.
Verona Tool Works

Rail Bonds
Verona Tool Works

Rail Braces
Bethlehem Steel Co.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

Rail Expanders
Ramapo Ajax Corp.

Rail Joints
See Joints, Rail

Rail Layers
Buckeye Traction Ditcher Co.
Nordberg Mfg. Co.

Rail Saws, Portable
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q. & C. Co.

Rail Springs
Verona Tool Works

Rails, Girder
Bethlehem Steel Co.

Rails, Tee
Bethlehem Steel Co.
Carnegie Steel Co.

Regulators, Oxy-Acetylene
Oxweld Railroad Service Co.

Replacers, Car & Locomotive
American Chain Co., Inc.
Buda Co.
Q. & C. Co.

Retaining Walls, Precast
Federal Cement Tile Co.
Massey Concrete Products Corp.

Rivets
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Rock Hammers
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.

Roof Slabs
Federal Cement Tile Co.
Massey Concrete Products Corp.

Roofing, Cement & Concrete Tile
Federal Cement Tile Co.

Roofing Composition
Barber Asphalt Co.

Rules
Lufkin Rule Co.

Rust Preventive
Dearborn Chemical Co.

Saw Rigs
American Saw Mill Machinery Co.
Fairbanks, Morse & Co.

Saws, Electric
Reed-Prentice Co.

Saws, High Speed Friction
American Saw Mill Machinery Co.

Saw Mills
American Saw Mill Machinery Co.

Scales, Tape
Lufkin Rule Co.

Scales, Track
Fairbanks, Morse & Co.

Scoops
Ames Shovel & Tool Co.

Screw Spikes
Illinois Steel Company

Screw Spike Drivers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Section Cars
See Cars, Section

Sharpeners, Rock Drill Steel
Ingersoll-Rand Co.

Sheathing Paper
Barber Asphalt Co.

Sheet Iron
Armco Culvert Mfrs. Assn.

Shingles, Composition
Barber Asphalt Co.

Shovels
Ames Shovel & Tool Co.
Verona Tool Works
Woodings Forge & Tool Co.

Shovels, Steam
Harnischfeger Corp.
Northwest Engineering Co.

Signals, Bridge & Warning
Hastings Signal & Equipment Co.

Siphons
Armco Culvert Mfrs. Assn.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Slabs, Concrete
Massey Concrete Products Corp.

Smokestacks
Chicago Bridge & Iron Works
Massey Concrete Products Corp.

Snow Melting Device
Lundie Engineering Corp.
Q. & C. Co.
Massey Concrete Products Corp.

Snow Plows
Jordan Co., O. F.
Q. & C. Co.

Spades
Ames Shovel & Tool Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Co.

Spreader Cars
See Cars, Spreader

Spreaders, Ballast
See Ballast Spreaders

Standpipes
Chicago Bridge & Iron Works.
Fairbanks, Morse & Co.

Stands, Switch & Target
Bethlehem Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel, Electric Furnace
Timken Roller Bearing Co.

Steel, Open Hearth
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Steel, Special Analysis
Timken Roller Bearing Co.

Step Joints
See Joints, Step

Storage Tanks
Chicago Bridge & Iron Works.
Pacific Tank & Pipe Co.

Storm Sewers, Corrugated Iron
Armco Culvert Mfrs. Assn.

Stream Enclosures, Corrugated Iron
Armco Culvert Mfrs. Assn.

Street Culverts, Part Circle
Armco Culvert Mfrs. Assn.

Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Switch Guard
Ramapo Ajax Corp.

Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switchmen's Houses
Massey Concrete Products Corp.

Switchstands & Fixtures
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers

Tanks & Fixtures
Fairbanks, Morse & Co.

Tanks, Fire Protection
Chicago Bridge & Iron Works

Tanks, Oil Storage
Chicago Bridge & Iron Works.

Tanks, Roadside Delivery
Chicago Bridge & Iron Works.
Pacific Tank & Pipe Co.

Tanks, Steel
Chicago Bridge & Iron Works

Tanks, Wood
Pacific Tank & Pipe Co.

Tapes, Measuring
Lufkin Rule Co.

Tee Rails
See Rails, Tee.

Telegraph Poles
See Poles

Telltales
Hastings Signal & Equipment Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Lundie Engineering Corp.
Q. & C. Co.

Ties
Jennison-Wright Co.
National Lumber & Creosoting Co.
Prettyman & Sons, J. F.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Rods
Bethlehem Steel Co.

Tie Scorer
Woolery Machine Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber
Southern Cypress Mfrs. Assn.

Timber, Creosoted
Jennison-Wright Co.
National Lumber & Creosoting Co.
Prettyman & Sons, J. F.

Tools, Drainage
Ames Shovel & Tool Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Ames Shovel & Tool Co.
Buda Co.
Q. & C. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy & Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Braces
See Braces, Track

Track Cranes
Buckeye Traction Ditcher Co.
Cullen-Friestedt Co.
Nordberg Mfg. Co.

Track Drills
See Drills, Track

Track Gages
Buda Co.
Kalamazoo Railway Supply Co.

Track Insulation
Q. & C. Co.

Track Jacks
See Jacks, Track

Track Levels
Kalamazoo Railway Supply Co.

Track Liners
See Liners, Track

Track, Special Work
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Track Tools
See Tools, Track

Trestle Slabs
Massey Concrete Products Corp.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Tunnel Warnings
Hastings Signal & Equipment Co.

Undercrossings, Corrugated Iron
Armco Culvert Mfrs. Assn.

Ventilators
Q. & C. Co.

Warning Devices, Bridge & Tunnel
Hastings Signal & Equipment Co.

Water Columns
Fairbanks, Morse & Co.

Water Cranes
Fairbanks, Morse & Co.

Water Tanks
Chicago Bridge & Iron Works.
Pacific Tank & Pipe Co.

Water Treating Plants
Dearborn Chemical Co.

Water Treating Tanks
Chicago Bridge & Iron Works.

Waterproofing Fabrics
Barber Asphalt Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding & Cutting Equipment
Oxweld Railroad Service Co.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Well Casings
Armco Culvert Mfrs. Assn.

Wheels, Hand & Motor Car
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

Windshields
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machinery Co.

ALPHABETICAL INDEX TO ADVERTISERS

A

American Chain Co., Inc. 53
American Saw Mill Machinery Co. 57
Ames Shovel & Tool Co. 22
Armco Culvert Mfrs. Ass'n. 11
Associated Business Papers, Inc. 50

B

Barber Asphalt Co. 57
Bethlehem Steel Co. 26
Buckeye Traction Ditcher Co. 16
Buda Co. 51

C

Calcyanide Co. 58
Carnegie Steel Co. 23
Central Foundry Co. 58
Chicago Bridge & Iron Works 33
Chicago Pneumatic Tool Co. 29
Chipman Chemical Engineering Co., Inc. 45
Cullen-Friestedt Co. 21

D

Dearborn Chemical Co. 54
Dixon Crucible Co., Jos. 53

E

Eclipse Air Brush Co. 56

F

Fairbanks, Morse & Co. 19-20
Fairmont Railway Motors, Inc. 4-5
Federal Cement Tile Co. 42

H

Harnischfeger Corp. 66
Hastings Signal & Equipment Co. 59
Hunt Co., R. W. 57

I

Illinois Steel Co. 9
Industrial Brownhoist Corp. 35
Ingersoll-Rand Co. 25

J

Jennison-Wright Co. 39
Jordan Co., O. F. 32

K

Kalamazoo Railway Supply Co. 27
Koppel Industrial Car & Equipment Co. 24

L

Lufkin Rule Co. 58
Lundie Engineering Corp. 3

M

Magor Car Corp. 51
Massey Concrete Products Corp. 12-13
Mechanical Mfg. Co. 55

N

National Lead Co. 34
National Lock Washer Co. 65
National Lumber & Creosoting Co. 57
Nordberg Mfg. Co. 37-38-46
Northwest Engineering Co. 7
Northwestern Motor Co. 14-15

O

Oxweld Railroad Service Co. 17

P

P. & M. Co. 1
Pacific Tank & Pipe Co. 58
Premax Products, Inc. 55
Prettyman & Sons, J. F. 59

Q

Q & C Co. 10

R

Rail Joint Co. 41
Ramapo Ajax Corp. 44
Reliance Mfg. Co. 2
Reed-Prentice Corp. 61
Richards-Wilcox Mfg. Co. 49

S

Sellers Mfg. Co. 63
Simmons-Boardman Publishing Co. 47-48-59
Southern Cypress Mfrs. Ass'n. 6
Sullivan Machinery Co. 59
Syntron Co. 30

T

Timken Roller Bearing Co. 36
Toncan Culvert Mfrs. Ass'n. 18

U

U. S. Graphite Co. 52
U. S. Pipe & Foundry Co. 8

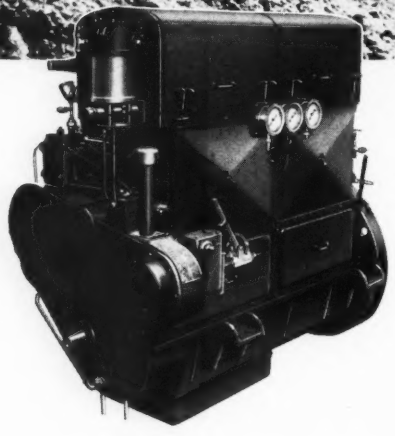
V

Verona Tool Works. 31

W

Wharton, Jr., & Co., Wm. 54
Woodings Forge & Tool Co. 28
Woolery Machine Co. 52

There is only one way to get Diesel Economy



The powerful P & H Diesel Engine was designed especially for excavator service. It has no equal for simplicity and reliability.

For excavators, Diesel Economy means a saving of from 75 to 85 per cent on fuel. It means the burning of low-price fuel. And only half as much is needed as for gasoline excavators.

It means 10 to 15 per cent more output. For your Diesel engine develops increasing torque as the load increases. Thus you have maximum power when you need it most.

But there is only one way to secure Diesel Economy. That is through Diesel Power. There is no substitute—no equivalent.

And in the P & H Diesel Excavators, Diesel Power can be used to the limit. They are designed and built for Diesel operation. They are Diesel machines from crawlers to boom tip.

Learn the reasons why these powerful machines do more for less and for longer. Ask for Bulletin 63-X.

HARNISCHFEGER CORPORATION

Established in 1884

3820 National Avenue, Milwaukee, Wisconsin

Atlanta	*Charlestown*	*Dallas*	*Jacksonville*	*Minneapolis*	*San Francisco*
Baltimore	*Charlotte*	*Des-Moines*	*Kansas City*	*New York*	*Seattle*
Birmingham	*Chicago*	*Detroit*	*Los Angeles*	*Philadelphia*	*St. Louis*
	Cleveland	*Indianapolis*	*Memphis*	*Pittsburgh*	

WAREHOUSES AND SERVICE STATIONS

Philadelphia, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle, Dallas

P&H DIESEL EXCAVATORS

1929

y

isco

s